

Subject

Introduction to the outcomes of MEPC 72

# **ClassNK**

## **Technical Information**

No. TEC-1156  
Date 19 July 2018

To whom it may concern

The seventy-second session of the Marine Environment Protection Committee (MEPC 72) was held at the IMO in London, U.K. from 9 to 13 April 2018. Since the minutes, resolutions and circulars of the meeting were recently released from the IMO, a summary of the decisions taken at MEPC 72 is provided as below for your information.

1. Greenhouse Gas (GHG) emissions

Countermeasures against the GHG emissions from international shipping have been deliberated at IMO, and so far, the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) have been implemented.

At MEPC 70, amendments to MARPOL Annex VI to include the Data Collection System for fuel oil consumption of ships as a measure to further improve the energy efficiency were adopted.

(1) Initial IMO Strategy on reduction of GHG emissions from ships

The Paris Agreement was adopted by consensus in December 2015 at the 21st Conference of the Parties of the UNFCCC (COP 21) and the ambitious target to limit the increase in the global average temperature to well below 2°C above pre-industrial levels, has been shared among the world. Thereafter, the reduction of GHG emissions from international shipping has been an urgent issue at IMO as well.

At MEPC 70, a roadmap for developing a comprehensive IMO strategy on reduction of GHG emissions from ships was approved. In accordance with this road map, an initial IMO strategy for reduction of GHG emissions needs to be developed by MEPC 72.

It has been discussed to develop the IMO strategy from MEPC 71. At this session, the Initial IMO strategy including below provisions was adopted. (Refer to MEPC.304(72) as attachment 4) To develop a follow-up action of the Initial IMO Strategy, a meeting of intersessional working group will be held in October, prior to MEPC 73.

(To be continued)

NOTES:

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Timelines	Ambition (compared to 2008)	Candidate measures
by 2030 (short-term)	To reduce CO <sub>2</sub> emissions per transport work by at least 40%	Establishment of an Existing Fleet Improvement Programme; Development of technical/operational energy efficiency measures; Research and development of alternative fuels; etc.
by 2050 (mid-term)	To reduce CO <sub>2</sub> emissions per transport work pursuing efforts towards 70%; or To reduce the total annual GHG emissions by at least 50%	Implementation programme of alternative low-carbon and zero-carbon fuels; Feedback mechanism to enable lessons learned on implementation of measures; Market-based Measures (MBMs); etc.
in this century (long-term)	To aims to phase GHG emissions out as soon as possible	New/Innovative emission reduction mechanism, etc.

(2) Review of technological developments for EEDI

Regulation 21.6 of MARPOL Annex VI requires, at the beginning of phase 1 and at the midpoint of phase 2, a review of the status of technological developments which may contribute to the improvement of EEDI should be conducted. It also requires, if proven necessary, to amend the subsequent requirements, i.e. "when to start the phase 3", "the EEDI reference line parameters" and "the reduction rate".

At MEPC 71, it was agreed to establish a correspondence group (CG), coordinated by Japan, to consider an early implementation of phase 3 and possible introduction of phase 4 and report to MEPC 74.

At this session, the progress of the work at CG was reported, in which a possible exemption of ice-strengthened ships constructed in accordance with ice classes higher than IA Super from EEDI requirements was proposed by CG. Further, analysis of compliance of large tonnage bulk carriers and tankers with EEDI phase 2 and phase 3 requirements and proposing amendments to the reference line parameters for such ship type is suggested. The Committee instructed the CG to consider further how ice class ships should be defined and excluded from the EEDI regulations, and the compliance of large tonnage bulk carriers and tankers with EEDI phase 2 and phase 3.

(To be continued)

## (3) Data Collection System for fuel oil consumption of ships

Amendments to MARPOL Annex VI to introduce the data collection system (DCS) for fuel oil consumption of ships entered into force on 1 March 2018, and carrying out of the data collection will be mandated from 1 January 2019. A review of the revised SEEMP including the Ship Fuel Oil Consumption Data Collection Plan (DCP), where a description of the methodology for data collecting is provided, should be completed prior to the data collection. At this session, MEPC circular which defines a form of Confirmation of Compliance to be issued upon the review of SEEMP was approved. Further, in the view point on a smooth implementation of these requirements, it was also agreed to specify in this MEPC circular an encouragement for early submission of the revised SEEMP by 1 September 2018.

(Refer to MEPC.1/Circ.876 as attachment 5)

Regarding the relevant requirements on IMO DCS, please refer to ClassNK Technical Information No.TEC-1139.

## 2. Air pollution - Sulphur content of fuel oils

At MEPC 70, it was agreed to set a global sulphur limit of 0.5% from 1 January 2020.

At this session, draft amendments to MARPOL Annex VI for a prohibition on the carriage of non-compliant fuel oil for combustion purpose with a sulphur content exceeding 0.50%, excluding for ships which are provided with exhaust gas cleaning system (EGCS), were approved. The amendments are expected to be adopted at MEPC 73.

## 3. Ballast Water Management Convention

Ballast Water Management Convention was adopted in 2004 in order to prevent the adverse effects to the marine environment caused by the transfer of ballast water, and entered into force on 8 September 2017. The Convention requires ships which discharge ballast water to conduct ballast water exchange (Regulation D-1) or treatment through Ballast Water Management Systems which meet the standard for the discharge of ballast water (Regulation D-2).

## (1) Code for approval of Ballast Water Management Systems

At MEPC 70, the revised G8 Guidelines was adopted to strengthen testing requirements for approval of the Systems. MEPC 70 also agreed to rename the G8 Guidelines as Code after the entry into force of the Convention.

At this session, the renamed Code for approval of Ballast Water Management systems (BWMS Code) was adopted. Further, amendments to *Guidance on scaling of ballast water management systems* (BWM.2 /Circ.33) and *Guidance for Administrations on the type approval process for ballast water management systems in accordance with Guidelines* (G8) (BWM.2/Circ.28 as amended by BWM.2/Circ.43) were also approved.

Ballast Water Management Systems which are installed on or after 28 October 2020 should be approved in accordance with BWMS Code.

(Refer to MEPC.296(72) as attachment 1, MEPC.300(72) as attachment 2, BWM.2 / Circ.33 Rev.1 as attachment 6 and BWM.2 / Circ.43 Rev.1 as attachment 7)

(To be continued)

## (2) Sampling and Analysis of Ballast Water at Initial Survey

IMO Assembly 30 (A 30), held in the last year, adopted Resolution A.1120(30) on *Survey Guidelines under the Harmonized System of Survey and Certification (HSSC), 2017*. The new survey provision related to sampling and analysis of treated ballast water at initial survey for the BWM Convention was included.

In light of the above, it was pointed out that the sampling and analysis are not required by BWM Convention or in the mandatory draft BWMS Code and no procedures for such sampling and analysis method have been developed yet.

As a result of the discussion, there was overwhelming agreement that the sampling and analysis should be carried out while their procedures of how such validation would be carried out should be clarified. Therefore, the Committee invited interested delegations to suggest proposals to formulate Guidance on the validation of the compliance of individual BWMS with regulation D-2 of the BWM Convention in conjunction with their commissioning.

## (3) Experience-building phase (EBP)

It was agreed to introduce an experience-building phase (EBP) to gather data in order to analyze and address any concerns for implementation of the BWM Convention at MEPC 68, and Resolution MEPC.290(71) to structuralize the EBP was adopted at MEPC 71.

At this session, BWM Circular providing analytical procedures for the data gathering and analysis plan for the EBP was approved. It is scheduled that the EBP will last for 5 years from the entry-into-force of the BWM Convention with following timelines.

(Refer to BWM.2/Circ.67 as attachment 8)

2017	:	entry into force of BWMC
2020	:	completion of data collection
Spring 2022	:	completion of data analysis
Autumn 2022	:	amendments to BWMC to be considered

## 4. Ship Recycling Convention

The Ship Recycling Convention (Hong Kong International Convention) was adopted in May 2009 for the Safe and Environmentally Sound Recycling of Ships. The convention requires a development and maintenance of an Inventory of Hazardous Materials which identifies the amount and location of hazardous materials onboard ships, and the ships shall only be recycled at ship recycling facilities authorized by the competent authority. The Convention will enter into force 24 months after ratification by 15 states, representing 40% of world merchant shipping by gross tonnage, and a maximum annual ship recycling volume not less than 3 per cent of the combined tonnage of the ratifying States. The Convention had already ratified by 6 States (i.e. Belgium, Republic of the Congo, Denmark, France, Norway and Panama).

At this session, Japan informed their recent efforts to encourage the entry into force of the Convention and the significant advancements that Japan and India had made towards accession to the Hong Kong Convention. Further, Turkey informed that they would ratify the Convention near future.

(To be continued)

## 5. Work programme for future investigation

### (1) Control and management of ships' biofouling

MEPC 62 adopted the *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (MEPC.207(62)), which is non-mandatory.

At this session, it was proposed to review the Guidelines for effective use, with a view to amending the Guidelines if required. As a result of the discussion, MEPC 72 agreed to instruct the Sub-Committee on pollution prevention and response (PPR) to consider this matter.

### (2) Marine plastic litter

With a view to tackling the problem of plastics in the oceans, MARPOL Annex V prohibits discharge of plastics from vessels. However, it was often pointed out that this prohibition regulation was not effective and that some additional actions were needed at IMO level to reduce plastic pollution in the marine environment. As a result of the discussion, MEPC 72 agreed to consider this issue at MEPC and at PPR Sub-Committee.

### (3) Use and carriage of heavy fuel oils in the Arctic area

Regulation 43 of MARPOL Annex I prohibits carriage of heavy grade oils as cargo or its use as fuel in the Antarctic area. Introduction of regulations applicable to the Arctic area had also been actively discussed until this session.

As a result of the discussion, it was agreed to task PPR Sub-Committee to consider a definition of Heavy Fuel Oils (HFO) and to prepare guidelines on mitigation measures to reduce risks of use and carriage of HFO as fuel. Further, the Committee urged Member States to submit concrete proposals to MEPC 73 on an appropriate impact assessment methodology process.

## 6. Amendments to mandatory instruments

MEPC 72 adopted amendments to mandatory instruments as follows:

### (1) BWMS Code

BWMS Code and amendments to regulation A-1/D-3 to refer the Code were adopted.  
(see paragraph 3.(1))

Entry into force: 13 October 2019

### (2) Reference line for ro-ro cargo ships and ro-ro passenger ships

Amendments to MARPOL VI were adopted to increase the reference line for ro-ro cargo ships and ro-ro passenger ships which have difficulties to comply with phase 2 requirements.  
(Refer to MEPC.301(72) as attachment 3)

Entry into force: 1 September 2019

(To be continued)

A summary of the outcomes of MEPC 72 is also available on the IMO web-site.  
<http://www.imo.org/MediaCentre/MeetingSummaries/MEPC/Pages/Default.aspx>

For any questions about the above, please contact:

NIPPON KAIJI KYOKAI (ClassNK)  
External Affairs Department, Administration Center Annex, Head Office  
Address: 3-3 Kioi-cho, Chiyoda-ku, Tokyo 102-0094, Japan  
Tel.: +81-3-5226-2038  
Fax: +81-3-5226-2734  
E-mail: [xad@classnk.or.jp](mailto:xad@classnk.or.jp)

Attachment:

1. Res. MEPC.296(72)
2. Res. MEPC.300(72)
3. Res. MEPC.301(72)
4. Res. MEPC.304(72)
5. MEPC.1/Circ.876
6. BWM.2 / Circ.33 Rev.1
7. BWM.2 / Circ.43 Rev.1
8. BWM.2/Circ.67

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**ANNEX 1**

**RESOLUTION MEPC.296(72)**  
**(adopted on 13 April 2018)**

**AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE CONTROL AND  
MANAGEMENT OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

**Amendments to regulations A-1 and D-3**  
**(Code for Approval of Ballast Water Management Systems (BWMS Code))**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING article 19 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), which specifies the amendment procedure and confers upon the Marine Environment Protection Committee of the Organization the function of considering amendments thereto for adoption by the Parties,

NOTING ALSO resolution MEPC.300(72), by which it adopted the Code for Approval of Ballast Water Management Systems (BWMS Code),

HAVING CONSIDERED, at its seventy-second session, proposed amendments to regulations A-1 and D-3 of the BWM Convention to make the provisions of the BWMS Code mandatory,

1 ADOPTS, in accordance with article 19(2)(c) of the BWM Convention, amendments to regulations A-1 and D-3, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 19(2)(e)(ii) of the BWM Convention, that the amendments shall be deemed to have been accepted on 13 April 2019 unless, prior to that date, more than one-third of the Parties have notified the Secretary-General that they object to the amendments;

3 INVITES the Parties to note that, in accordance with article 19(2)(f)(ii) of the BWM Convention, the said amendments shall enter into force on 13 October 2019 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article 19(2)(d) of the BWM Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the BWM Convention;

5 REQUESTS ALSO the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to the BWM Convention;

6 REQUESTS FURTHER the Secretary-General to prepare a consolidated certified text of the BWM Convention.

ANNEX

**AMENDMENTS TO THE ANNEX TO THE BWM CONVENTION**

**(BWMS Code)**

**Section A – General provisions**

**Regulation A-1 – Definitions**

1 A new paragraph 8 is added as follows:

"8 "BWMS Code" means the *Code for Approval of Ballast Water Management Systems* adopted by resolution MEPC.300(72), as may be amended by the Organization, provided that such amendments are adopted and brought into force in accordance with article 19 of the present Convention relating to amendment procedures applicable to the Annex."

**Section D – Standards for ballast water management**

**Regulation D-3 – Approval requirements for ballast water management systems**

2 Paragraph 1 is replaced with the following:

"1 Except as specified in paragraph 2, ballast water management systems used to comply with this Convention shall be approved by the Administration as follows:

.1 ballast water management systems installed<sup>1</sup> on or after 28 October 2020 shall be approved in accordance with the BWMS Code, as may be amended; and

.2 ballast water management systems installed<sup>1</sup> before 28 October 2020 shall be approved taking into account the guidelines<sup>2</sup> developed by the Organization or the BWMS Code, as may be amended."

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1 Refer to paragraph 2 of the Unified interpretation of appendix I (Form of the International Ballast Water Management Certificate) of the BWM Convention related to "date installed" contained in BWM.2/Circ.66.

2 Refer to resolutions MEPC.125(53), MEPC.174(58) or MEPC.279(70), as appropriate."

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**ANNEX 5**

**RESOLUTION MEPC.300(72)  
(adopted on 13 April 2018)**

**CODE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS  
(BWMS CODE)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that regulation D-3 of the Annex to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), provides that ballast water management systems used to comply with the Convention must be approved by the Administration,

NOTING ALSO that it adopted, by resolution MEPC.125(53), *Guidelines for approval of ballast water management systems* (Guidelines (G8)), and by resolutions MEPC.174(58) and MEPC.279(70) revisions thereof,

DESIRING to make the Guidelines (G8) mandatory under the BWM Convention in the form of a code for approval of ballast water management systems,

NOTING resolution MEPC.296(72), by which it adopted amendments to regulations A-1 and D-3 of the BWM Convention to make the provisions of the Code for Approval of Ballast Water Management Systems referred to above mandatory,

RECALLING that it agreed, at its sixty-eighth session, to provisions for non-penalization of early movers that have installed ballast water management systems approved taking into account resolutions MEPC.125(53) and MEPC.174(58), as contained in the Roadmap for the implementation of the BWM Convention,

BEARING IN MIND the Organization's established practice with regard to the validity of type approval certification for marine products (MSC.1/Circ.1221), which is that the Type Approval Certificate itself has no influence on the operational validity of existing ballast water management systems approved and installed on board a ship and manufactured during the period of validity of the relevant Type Approval Certificate, meaning that the system need not be renewed or replaced due to expiration of such Certificate,

HAVING CONSIDERED, at its seventy-second session, the draft Code for Approval of Ballast Water Management Systems,

1 ADOPTS the *Code for Approval of Ballast Water Management Systems (BWMS Code)*, as set out in the annex to the present resolution;

2 INVITES Parties to the BWM Convention to note that the BWMS Code will take effect on 13 October 2019 upon entry into force of the associated amendments to the BWM Convention;

3 AGREES to keep the BWMS Code under review in the light of experience gained with its application and to amend it as necessary;

4 DECIDES that ballast water management systems approved not later than 28 October 2018, taking into account the Guidelines (G8) adopted by resolution MEPC.174(58), may be installed on board ships before 28 October 2020;

5 RESOLVES that, for the purpose of operative paragraph 4 of this resolution, the word "installed" means the contractual date of delivery of the ballast water management system to the ship. In the absence of such a date, the word "installed" means the actual date of delivery of the ballast water management system to the ship;

6 RESOLVES that references to the Guidelines (G8) and 2016 Guidelines (G8) in existing IMO instruments should be read to mean references to the BWMS Code;

7 AGREES that the dates referenced in this resolution will be considered in any reviews carried out in accordance with regulation D-5 of the BWM Convention, to determine whether a sufficient number of appropriate technologies are approved and available;

8 RESOLVES to revoke the *2016 Guidelines for approval of ballast water management systems* (G8) adopted by resolution MEPC.279(70) when the BWMS Code takes effect;

9 REQUESTS the Secretary-General to transmit certified copies of the present resolution and the text of the BWMS Code contained in the annex to all Parties to the BWM Convention;

10 REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and the text of the BWMS Code contained in the annex to the Members of the Organization which are not Parties to the BWM Convention.

ANNEX

**CODE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS  
(BWMS CODE)**

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## 1 INTRODUCTION

### General

1.1 The Code for Approval of Ballast Water Management Systems (BWMS Code) is aimed primarily at Administrations, or their designated bodies, in order to assess whether ballast water management systems (BWMS) meet the standard set out in regulation D-2 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Convention). In addition, the Code is intended for manufacturers and shipowners as a reference on the evaluation procedure that equipment will undergo and the requirements placed on BWMS. The Code should be applied in an objective, consistent and transparent way and its application should be evaluated periodically by the Organization.

1.2 Articles and regulations referred to in this Code are those contained in the Convention.

1.3 The Code includes general requirements concerning the design, installation, performance, testing, environmental acceptability, technical procedures for evaluation and procedures for issuance of Type Approval Certificates of BWMS and reporting to the Organization.

1.4 The Code is intended to fit within an overall framework for evaluating the performance of systems that includes the experimental shipboard evaluation of prototype systems under the provisions of regulation D-4, approval of BWMS and associated systems that comply fully with the requirements of the Convention, and port State control sampling for compliance under the provisions of article 9 of the Convention.

1.5 The approval requirements of regulation D-3 stipulate that BWMS used to comply with the Convention must be approved by the Administration, in accordance with this Code. In addition to such BWMS approval, as set forth in regulation A-2 and regulation B-3, the Convention requires that discharges of ballast water from ships must meet the regulation D-2 performance standard on an on-going basis. Approval of a system is intended to screen out BWMS that would fail to meet the standards prescribed in regulation D-2 of the Convention. Approval of a system, however, does not ensure that a given system will work on all ships or in all situations. To satisfy the Convention, a discharge must comply with the D-2 standard throughout the life of the ship.

1.6 BWMS shall be designed to not impair the health and safety of the ship or personnel, nor to present any unacceptable harm to the environment or to public health.

1.7 BWMS shall meet the standards of regulation D-2 and the conditions established in regulation D-3 of the Convention. The Code serves to evaluate the safety, environmental acceptability, practicability and biological effectiveness of the systems designed to meet these standards and conditions. The cost effectiveness of type-approved equipment will be used in determining the need for revisions of the Code.

1.8 To achieve consistency in its application, the approval procedure requires that a uniform manner of testing, analysis of samples, and evaluation of results is developed and applied. Amendments to this Code shall be duly circulated by the Secretary-General. Due consideration shall be given to the practicability of the BWMS.

## Goal and purpose

1.9 The goal of the Code is to ensure uniform and proper application of the standards contained in the Convention. As such the Code should be updated as the state of knowledge and technology may require.

1.10 The purpose of the Code is to provide a uniform interpretation and application of the requirements of regulation D-3 and to:

- .1 define test and performance requirements for the approval of BWMS;
- .2 set out appropriate design, construction and operational parameters necessary for the approval of BWMS;
- .3 provide direction to Administrations, equipment manufacturers and shipowners in determining the suitability of equipment to meet the requirements of the Convention and of the environmental acceptability of treated water; and
- .4 ensure that BWMS approved by Administrations are capable of achieving the standard of regulation D-2 in land-based and shipboard evaluations and do not cause unacceptable harm to the ship, the crew, the environment or public health.

## Applicability

1.11 This Code applies to the approval of BWMS in accordance with the Convention.

1.12 This Code applies to BWMS intended for installation on board all ships required to comply with regulation D-2.

1.13 BWMS approved taking into account the 2016 Guidelines (G8) adopted by resolution MEPC.279(70) shall be deemed to be in accordance with the BWMS Code.

## 2 BACKGROUND

2.1 The requirements of the Convention relating to approval of BWMS used by ships are set out in regulation D-3.

2.2 Regulation D-2 stipulates that ships conducting ballast water management in accordance with the ballast water performance standard of the Convention shall discharge:

- .1 less than 10 viable organisms per cubic metre greater than or equal to 50  $\mu\text{m}$  in minimum dimension;
- .2 less than 10 viable organisms per millilitre less than 50  $\mu\text{m}$  in minimum dimension and greater than or equal to 10  $\mu\text{m}$  in minimum dimension; and

- .3 less than the following concentrations of indicator microbes, as a human health standard:
  - .1 Toxicogenic *Vibrio cholerae* (serotypes O1 and O139) with less than 1 colony forming unit (cfu) per 100 mL or less than 1 cfu per 1 g (wet weight) of zooplankton samples;
  - .2 *Escherichia coli* less than 250 cfu per 100 mL; and
  - .3 Intestinal Enterococci less than 100 cfu per 100 mL.

### 3 DEFINITIONS

For the purpose of this Code:

3.1 *Active Substance* means a substance or organism, including a virus or a fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens.

3.2 *Ballast water management system (BWMS)* means any system which processes ballast water such that it meets or exceeds the ballast water performance standard in regulation D-2. The BWMS includes ballast water treatment equipment, all associated control equipment, piping arrangements as specified by the manufacturer, control and monitoring equipment and sampling facilities. For the purpose of this Code, BWMS does not include the ship's ballast water fittings, which may include piping, valves, pumps, etc., that would be required if the BWMS was not fitted.

3.3 *Ballast water management plan* means the plan referred to in regulation B-1 of the Convention describing the ballast water management process and procedures implemented on board individual ships.

3.4 *Control and monitoring equipment* means the equipment installed for the effective operation and control of the BWMS and the assessment of its effective operation.

3.5 *Convention* means the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

3.6 *Failed test cycle* is a valid test cycle in which the performance of the BWMS resulted in treated water that is determined to be non-compliant with the standard set within regulation D-2. A failed test cycle interrupts the required consecutive test cycles and terminates the test.

3.7 *Invalid test cycle* is a test cycle in which, due to circumstances outside the control of the BWMS, the requirements for a valid test cycle are not met. When a test cycle is invalid, it does not count as one of the required consecutive test cycles in a test and the test can be continued.

3.8 *Land-based testing* means a test of the BWMS carried out in a laboratory, equipment factory or pilot plant including a moored test barge or test ship, according to Parts 2 and 3 of the annex to this Code, to confirm that the BWMS meets the ballast water performance standard described in regulation D-2 of the Convention.

3.9 *Major components* means those components that directly affect the ability of the system to meet the ballast water performance standard described in regulation D-2.

3.10 *Representative sampling* means sampling that reflects the relative concentrations (chemicals) and numbers and composition of the populations (organisms) in the volume of interest. Samples shall be taken in a time-integrated manner and the sampling facility shall be installed, taking into account guidelines developed by the Organization.<sup>1</sup>

3.11 *Sampling facilities* refers to the means provided for sampling treated or untreated ballast water as needed in this Code and in the guidelines developed by the Organization.<sup>1</sup>

3.12 *Shipboard testing* means a full-scale test of a complete BWMS carried out on board a ship according to part 2 of the annex to this Code, to confirm that the system meets the standards set by regulation D-2 of the Convention.

3.13 *Successful test cycle* means a valid test cycle where the BWMS functions to its specifications and treated water is determined to meet the ballast water performance standard described in regulation D-2.

3.14 *System Design Limitations (SDL)* of a BWMS means the water quality and operational parameters, determined in addition to the required type approval testing parameters, that are important to its operation, and, for each such parameter, a low and/or a high value for which the BWMS is designed to achieve the performance standard of regulation D-2. The SDL should be specific to the processes being employed by the BWMS and should not be limited to parameters otherwise assessed as part of the type approval process. The SDL should be identified by the manufacturer and validated under the supervision of the Administration, taking into account Guidance developed by the Organization, and in accordance with this Code.

3.15 *Test cycle* refers to one testing iteration (to include uptake, treatment, holding and discharge as appropriate) under a given set of requirements used to establish the ability of a BWMS to meet the set standards.

3.16 *Test* means the set of required test cycles.

3.17 *Treatment Rated Capacity (TRC)* means the maximum continuous capacity expressed in cubic metres per hour for which the BWMS is type-approved. It states the amount of ballast water that can be treated per unit time by the BWMS to meet the ballast water performance standard in regulation D-2. The TRC is measured at the inlet of the BWMS.

3.18 *Valid test cycle* means a test cycle in which all the required test conditions and arrangements, including challenge conditions, test control, and monitoring arrangements (including piping, mechanical and electrical provisions) and test analytical procedures were achieved by the test organization.

3.19 *Viable organisms* means organisms that have the ability to successfully generate new individuals in order to reproduce the species.

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<sup>1</sup> Refer to the *Guidelines for ballast water sampling (G2)* (resolution MEPC.173(58)).

## **4 TECHNICAL SPECIFICATIONS**

4.1 This section details the general technical requirements which a BWMS shall meet in order to obtain type approval.

### **General principles for operation**

4.2 A BWMS shall be effective in meeting the D-2 standard on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature, unless the system is intentionally constructed for use in specific waters.

4.3 Ballast water discharged following treatment shall be safe for the environment on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature.

4.4 The design of the BWMS shall account for the fact that, regardless of the BWMS technology employed, viable organisms remaining after treatment may reproduce in the interval between treatment and discharge.

### **Ballast water management systems**

4.5 The BWMS shall be designed and constructed:

- .1 for robust and suitable operation in the shipboard environment;
- .2 for the service for which it is intended;
- .3 to mitigate any danger to persons on board when installed. Equipment that could emit dangerous gases/liquids shall have at least two independent means of detection and shutdown of the BWMS (i.e. hazardous gas level reaching lower explosive limits (LEL) or level of toxic concentrations that can result in severe effects on human health); and
- .4 with materials compatible with: the substances used; the purpose for which it is intended; the working conditions to which it will be subjected; and the environmental conditions on board.

4.6 The BWMS shall not contain or use any substance of a dangerous nature, unless adequate risk mitigation measures are incorporated for storage, application, installation and safe handling, acceptable to the Administration.

4.7 In case of any failure compromising the proper operation of the BWMS, audible and visual alarm signals shall be given in all stations from which ballast water operations are controlled.

4.8 All working parts of the BWMS that are liable to wear or to be damaged shall be easily accessible for maintenance. The routine maintenance of the BWMS and troubleshooting procedures shall be clearly defined by the manufacturer in the operation, maintenance and safety manual. All maintenance and repairs shall be recorded.

4.9 To avoid interference with the BWMS, the following items shall be included:

- .1 every access of the BWMS beyond the essential requirements of paragraph 4.8 shall require the breaking of a seal;



- .2 if applicable, the BWMS shall be so constructed that a visual indication is always activated whenever the BWMS is in operation for purposes of cleaning, calibration or repair, and these events shall be recorded by the control and monitoring equipment; and
- .3 the BWMS shall be provided with the necessary connections to ensure that any bypass of the BWMS will activate an alarm, and that the bypass event is recorded by the control and monitoring equipment.

4.10 Facilities shall be provided for checking, at the renewal surveys and according to the manufacturer's instructions, the performance of the BWMS components that take measurements. A calibration certificate certifying the date of the last calibration check shall be retained on board for inspection purposes. Only the manufacturer or persons authorized by the manufacturer shall perform the accuracy checks.

4.11 The BWMS shall be provided with simple and effective means for its operation and control. It shall be provided with a control system that shall be such that the services needed for the proper operation of the BWMS are ensured through the necessary arrangements.

4.12 The BWMS shall, if intended to be fitted in hazardous area locations, comply with the relevant safety regulations for such spaces. Any electrical equipment that is part of the BWMS shall be based in a non-hazardous area, or shall be certified by the Administration as safe for use in a hazardous area. Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.

4.13 The BWMS shall be designed so as not to endanger the health and safety of the crew, interact negatively with the ship's systems and cargo or produce any adverse environmental effects. The BWMS shall not create long-term impacts on the safety of the ship and crew through corrosive effects in the ballast system and other spaces.

4.14 It shall be demonstrated, by using mathematical modelling and/or calculations, that any up or down scaling of the BWMS will not affect the functioning and effectiveness on board a ship of the type and size for which the equipment will be certified. In doing so, the manufacturer of the equipment shall take into account the relevant guidance developed by the Organization.

4.15 Scaling information shall allow the Administration to verify that any scaled model is at least as robust as the land-based-tested model. It is the responsibility of the Administration to verify that the scaling used is appropriate for the operational design of the BWMS.

4.16 At a minimum, the shipboard test unit shall be of a capacity that allows for further validation of the mathematical modelling and/or calculations for scaling, and preferably selected at the upper limit of the rated capacity of the BWMS, unless otherwise approved by the Administration.

### **Control and monitoring equipment**

4.17 Administrations shall ensure that type-approved BWMS have a suitable control and monitoring system that will automatically monitor and record sufficient data to verify correct operation of the system. The control and monitoring equipment shall record the proper functioning or failure of the BWMS. Where practical, SDL parameters should be monitored and recorded by the BWMS to ensure proper operation.

4.18 The BWMS shall incorporate control equipment that automatically monitors and adjusts necessary treatment dosages or intensities or other aspects of the BWMS of the ship, which while not directly affecting treatment, are nonetheless required for proper administration of the necessary treatment.

4.19 The equipment shall be able to produce (e.g. display, print or export) a report of the applicable self-monitoring parameters in accordance with part 5 of the annex for official inspections or maintenance, as required.

4.20 To facilitate compliance with regulation B-2, the control and monitoring equipment shall also be able to store data for at least 24 months. In the event that the control and monitoring equipment is replaced, means shall be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

4.21 For BWMS that could emit dangerous gases, a means of gas detection by redundant safety systems shall be fitted in the space of the BWMS, and an audible and visual alarm shall be activated at a local area and at a manned BWMS control station in case of leakage. The gas detection device shall be designed and tested in accordance with IEC 60079-29-1 or other recognized standards acceptable to the Administration. Monitoring measures for dangerous gases with independent shutdown shall be provided on the BWMS.

4.22 All software changes introduced to the system after the pre-test evaluation shall be done according to a change handling procedure ensuring traceability.

## **5 TYPE APPROVAL PROCESS**

5.1 The type approval requirements for BWMS are as described below.

5.2 The manufacturer of the equipment shall submit information regarding the design, construction, operation and functioning of the BWMS in accordance with Part 1 of the annex, including information regarding the water quality and operational parameters that are important to the operation of the system. This information shall be the basis for a first evaluation of suitability by the Administration.

5.3 Following the Administration's pre-test evaluation, the BWMS shall undergo land-based, shipboard and other tests in accordance with the procedures described in Parts 2 and 3 of the annex. The BWMS tested for type approval shall be a final and complete product that meets the requirements of section 4 and it shall be constructed using the same materials and procedures that will be used to construct production units.

5.4 Successful fulfilment of the requirements and procedures outlined in Parts 2 and 3 of the annex, as well as all other requirements of this Code, shall lead to the issuance of a Type Approval Certificate by the Administration in accordance with section 6.

5.5 The limitations of the BWMS, in addition to the required type approval testing parameters identified in paragraphs 2.29 and 2.46 of the annex, as submitted by its manufacturer and validated by the Administration, shall be documented on the Type Approval Certificate. These design limitations do not determine if the equipment may be type-approved or not, but provide information on the conditions beyond the type approval testing parameters under which proper functioning of the equipment can be expected.

5.6 When a type-approved BWMS is installed on board, an installation survey according to section 8 shall be carried out.

5.7 The documentation submitted for approval shall include at least the following:

- .1 a description and diagrammatic drawings of the BWMS;
- .2 the operation, maintenance and safety manual;
- .3 hazard identification;
- .4 environmental and public health impacts; and
- .5 System Design Limitations.

## **6 APPROVAL AND CERTIFICATION PROCEDURES**

6.1 A BWMS which in every respect fulfils the requirements of this Code may be approved by the Administration for fitting on board ships. The approval shall take the form of a Type Approval Certificate of BWMS, specifying the main particulars of the BWMS and validated SDL. Such certificates shall be issued in accordance with Part 7 of the annex in the format shown in the appendix.

6.2 A BWMS that in every respect fulfils the requirements of this Code except that it has not been tested at all the temperatures and salinities set out in Part 2 of the annex shall only be approved by the Administration if corresponding limiting operating conditions are clearly stated on the issued Type Approval Certificate with the description "Limiting Operating Conditions". For the limiting values, the SDL shall be consulted.

6.3 A Type Approval Certificate of a BWMS shall be issued for the specific application for which the BWMS is approved, e.g. for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting operating conditions or circumstances as appropriate.

6.4 A Type Approval Certificate of a BWMS shall be issued by the Administration based on satisfactory compliance with all the requirements described in Parts 1, 2, 3 and 4 of the annex.

6.5 The SDL shall be specified on the Type Approval Certificate in a table that identifies each water quality and operational parameter together with the validated low and/or high parameter values for which the BWMS is designed to achieve the ballast water performance standard described in regulation D-2.

6.6 An Administration may issue a Type Approval Certificate of a BWMS based on testing already carried out under supervision by another Administration. In cases where the approval of a BWMS by an Administration for installation on a ship operating under its authority is to be granted on the basis of testing carried out by another Administration, the approval may be conveyed through the issuance of the International Ballast Water Management Certificate.

6.7 A Type Approval Certificate shall only be issued to a BWMS that has been determined by the Administration to make use of an Active Substance after it has been approved by the Organization in accordance with regulation D-3.2. In addition, the Administration shall ensure that any recommendations that accompanied the Organization's approval have been taken into account before issuing the Type Approval Certificate.

6.8 The Type Approval Certificate shall be issued taking into account guidance developed by the Organization.<sup>2</sup>

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<sup>2</sup> Refer to *Validity of type approval certification for marine products* (MSC.1/Circ.1221).

6.9 An approved BWMS may be type approved by other Administrations for use on their ships. Should a BWMS approved by one country fail type approval in another country, then the two countries concerned shall consult one another with a view to reaching a mutually acceptable agreement.

6.10 An Administration approving a BWMS shall promptly provide a type-approval report to the Organization in accordance with part 6 of the annex. Upon receipt of a type-approval report, the Organization shall promptly make it available to the public and Member States by appropriate means.

6.11 In the case of a type approval based entirely on testing already carried out under supervision by another Administration, the type-approval report shall be prepared and kept on file and the Organization shall be informed of the approval.

6.12 In the case of a BWMS that was previously type-approved by an Administration taking into account the revised Guidelines (G8) adopted by resolution MEPC.174(58), the manufacturer, in seeking a new type approval under this Code, shall only be requested to submit to the Administration the additional test reports and documentation set out in this Code.

## **7 INSTALLATION REQUIREMENTS FOLLOWING TYPE APPROVAL**

7.1 The BWMS shall be accompanied by sampling facilities installed taking into account guidelines developed by the Organization,<sup>3</sup> so arranged in order to collect representative samples of the ship's ballast water discharge.

7.2 Suitable bypasses or overrides to protect the safety of the ship and personnel shall be installed and used in the event of an emergency and these shall be connected to the BWMS so that any bypass of the BWMS shall activate an alarm. The bypass event shall be recorded by the control and monitoring equipment and within the ballast water record book.

7.3 The requirement in paragraph 7.2 does not apply to internal transfer of ballast water within the ship (e.g. anti-heeling operations). For BWMS that transfer water internally which may affect compliance by the ship with the standard described in regulation D-2 (i.e. circulation or in-tank treatment) the recording in paragraph 7.2 shall identify such internal transfer operations.

## **8 INSTALLATION SURVEY AND COMMISSIONING PROCEDURES FOLLOWING TYPE APPROVAL**

8.1 The additional information outlined in the paragraphs below is intended to facilitate ship operations and inspections and assist ships and Administrations in preparing for the procedures set out in the *Survey Guidelines for the purpose of the International Convention for the Control and Management of Ships' Ballast Water and Sediments under the Harmonized System of Survey and Certification*,<sup>4</sup> developed by the Organization, which describe the examination of plans and designs and the various surveys required under regulation E-1.

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<sup>3</sup> Refer to the *Guidelines for ballast water sampling (G2)* (resolution MEPC.173(58)).

<sup>4</sup> Refer to the *Survey Guidelines under the Harmonized System of Survey and Certification (HSSC), 2017* (resolution A.1120(30)).

8.2 The Administration issuing the International Ballast Water Management Certificate shall verify that the following documentation is on board in a suitable format:

- .1 for the purpose of information, a copy of the Type Approval Certificate of the BWMS;
- .2 the operation, maintenance and safety manual of the BWMS;
- .3 the ballast water management plan of the ship;
- .4 installation specifications, e.g. installation drawing, piping and instrumentation diagrams, etc.; and
- .5 installation commissioning procedures.

8.3 Prior to the issuance of the International Ballast Water Management Certificate, following the installation of a BWMS, the Administration should verify that:

- .1 the BWMS installation has been carried out in accordance with the technical installation specification referred to in paragraph 8.2.4;
- .2 the BWMS is in conformity with the relevant Type Approval Certificate BWMS;
- .3 the installation of the complete BWMS has been carried out in accordance with the manufacturer's equipment specification;
- .4 any operational inlets and outlets are located in the positions indicated on the drawing of the pumping and piping arrangements;
- .5 the workmanship of the installation is satisfactory and, in particular, that any bulkhead penetrations or penetrations of the ballast system piping are to the relevant approved standards; and
- .6 the installation commissioning procedures have been completed.

Annex

**PART 1 – SPECIFICATIONS FOR PRE-TEST EVALUATION OF SYSTEM DOCUMENTATION**

1.1 Adequate documentation shall be prepared and submitted to the Administration and be shared with the test organization as part of the approval process well in advance of the intended approval testing of a BWMS. Approval of the submitted documentation shall be a prerequisite for carrying out independent approval tests.

1.2 Documentation shall be provided by the manufacturer/developer for two primary purposes: evaluating the readiness of the BWMS for undergoing approval testing and evaluating the manufacturer's proposed SDL and validation procedures.

**Documentation**

1.3 The documentation to be submitted as a part of the readiness evaluation shall include at least the following:

- .1 a BWMS technical specification, including at least:
  - .1 a description of the BWMS, treatment processes it employs and details of any required permits;
  - .2 adequate information including descriptions and diagrammatic drawings of the pumping and piping arrangements, electrical/electronic wiring, monitoring system, waste streams and sampling points. Such information should enable fault finding;
  - .3 details of major components and materials used (including certificates where appropriate);
  - .4 an equipment list showing all components subject to testing including specifications, materials and serial numbers;
  - .5 an installation specification in accordance with manufacturers installation criteria requirements for the location and mounting of components, arrangements for maintaining the integrity of the boundary between safe and hazardous spaces and the arrangement of the sample piping;
  - .6 information regarding the characteristics and arrangements in which the system is to be installed, including scope of the ships (sizes, types and operation) for which the system is intended. This information may form the link between the system and the ship's ballast water management plan; and
  - .7 a description of BWMS side streams (e.g. filtered material, centrifugal concentrate, waste or residual chemicals) including a description of the actions planned to properly manage and dispose of such wastes;

- .2 the operation, maintenance and safety manual, including at least:
  - .1 instructions for the correct operation of the BWMS, including procedures for the discharge of untreated water in the event of malfunction of the ballast water treatment equipment;
  - .2 instructions for the correct arrangement of the BWMS;
  - .3 maintenance and safety instructions and the need to keep records;
  - .4 troubleshooting procedures;
  - .5 emergency procedures necessary for securing the ship;
  - .6 any supplementary information considered necessary for the safe and efficient operation of the BWMS, e.g. documentation provided for approval under the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)); and
  - .7 calibration procedures;
- .3 information on any hazard identification conducted to identify potential hazards and define appropriate control measures, if the BWMS or the storage tanks for processing chemicals could emit dangerous gases or liquids;
- .4 information regarding environmental and public health impacts including:
  - .1 identification of potential hazards to the environment based on environmental studies performed to the extent necessary to assure that no harmful effects are to be expected;
  - .2 in the case of BWMS that make use of Active Substances or Preparations containing one or more Active Substances, the dosage of any Active Substances used and the maximum allowable discharge concentrations;
  - .3 in the case of BWMS that do not make use of Active Substances or preparations, but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge, the documentation shall include results of toxicity tests of treated water as described in paragraph 2.19 of this annex; and
  - .4 sufficient information to enable the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams;
- .5 information regarding SDL including:
  - .1 the identification of all known parameters to which the design of the BWMS is sensitive;

- .2 for each parameter the manufacturer shall claim a low and/or a high value for which the BWMS is capable of achieving the Performance Standard of regulation D-2; and
- .3 the proposed method for validating each claimed SDL shall be set out, together with information on the source, suitability and reliability of the method;
- .6 a software change handling and revision control document including all software changes introduced to the system after the pre-test evaluation. These shall be done according to a change handling procedure ensuring traceability. Therefore, the manufacturer shall present a procedure describing how changes are to be handled and how revision control is maintained. As a minimum for a modification request, the following types of information shall be produced and logged:
  - .1 reason for modification;
  - .2 specification of the proposed change;
  - .3 authorization of modification; and
  - .4 test record;
- .7 functional description including a textual description with necessary supporting drawings, diagrams and figures to cover:
  - .1 system configuration and arrangement;
  - .2 scope of supply;
  - .3 system functionality covering control, monitoring, alarm and safety functions;
  - .4 self-diagnostics and alarming functionalities; and
  - .5 safe states for each function implemented.

1.4 The documentation may include specific information relevant to the test set-up to be used for land-based testing according to this Code. Such information should include the sampling needed to ensure proper functioning and any other relevant information needed to ensure proper evaluation of the efficacy and effects of the equipment. The information provided should also address general compliance with applicable environment, health and safety standards during the type-approval procedure.

### **Readiness evaluation**

1.5 During the readiness evaluation, the Administration shall ensure that each technical specification set out in section 4 of this Code has been met, other than those that will be assessed during later testing.



1.6 The readiness evaluation shall examine the design and construction of the BWMS to determine whether there are any fundamental problems that might constrain the ability of the BWMS to manage ballast water as proposed by the manufacturer, or to operate safely, on board ships.

1.7 Administrations shall ensure adequate risk assessments including the implementation of preventative actions have been undertaken relating to the safe operation of BWMS.

1.8 As a first step the manufacturer shall provide information regarding the requirements and procedures for installing, calibrating and operating (including maintenance requirements) the BWMS during a test. This evaluation should help the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams.

1.9 The test facility shall have a procedure to deal with deviations that occur prior to testing and an evaluation process which includes an assessment and validation process to address any unforeseen deviations that may occur during testing. Deviations from the testing procedure shall be fully reported.

1.10 During the readiness evaluation the major components of the BWMS shall be identified. Major components are considered to be those components that directly affect the ability of the system to meet the performance standard described in regulation D-2. Upgrades or changes to major components shall not take place during type approval testing. A change to a major component requires a new submission of the test proposal and shall involve a new evaluation and repeating of the land-based and shipboard tests.

1.11 The Administration may allow replacements of non-major components of equivalent specification (independently approved to a recognized and equal operational standard) during type approval. Replacements of non-major components during testing shall be reported.

1.12 Upgrades of the BWMS that relate to the safe operation of that system may be allowed during and after type approval and shall be reported. If such safety upgrades directly affect the ability of the system to meet the standard described in regulation D-2, it shall be treated as a change of a major component, as per paragraph 1.10 above.

1.13 The evaluation shall identify consumable components in the BWMS. The Administration may allow replacement of like-for-like consumable components during type approval testing and all replacements shall be reported.

#### **System Design Limitation evaluation**

1.14 The SDL evaluation shall be undertaken by the Administration. It shall assess the basis for the manufacturer's claim that the SDL include all known water quality and operational parameters to which the design of the BWMS is sensitive and that are important to its ability to achieve the performance standard described in regulation D-2.

1.15 The Administration shall also evaluate the suitability and reliability of the methods proposed for validating the claimed low and/or high values for each SDL. These methods may include tests to be undertaken during land-based, shipboard or bench-scale testing and/or the use of appropriate existing data and/or models.

## **PART 2 –TEST AND PERFORMANCE SPECIFICATIONS FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS**

2.1 The Administration decides the sequence of land-based and shipboard testing. The BWMS used for testing must be verified by the Administration to be the same as the BWMS described under Part 1 of the annex with major components as described in the documentation submitted in accordance with paragraphs 1.3.1.3 and 1.3.1.4 of this annex.

### **Quality assurance and quality control procedures**

2.2 The test facility shall demonstrate its competency in conducting valid type approval tests in two ways:

- .1 by having implemented a rigorous quality control/quality assurance programme, approved, certified and audited by an independent accreditation body, or to the satisfaction of the Administration; and
- .2 by demonstrating its ability to conduct valid test cycles with appropriate challenge water, sample collection, sample analysis and method detection limits.

It is the responsibility of the Administration, or its authorized delegate, to determine the acceptability of the test facility.

2.3 The test facility's quality control/quality assurance programme shall consist of:

- .1 a Quality Management Plan (QMP), which addresses the quality control management structure and policies of the testing body (including subcontractors and outside laboratories);
- .2 a Quality Assurance Project Plan (QAPP), which defines the methods, procedures, and quality assurance and quality control (QA/QC) protocols used by the test facility for testing BWMS in general. It identifies the test team members, and it includes all relevant standard operating procedures (SOPs), typically as appendices; and
- .3 a Test/Quality Assurance Plan (TQAP), that provides specific details for conducting a test of a given BWMS at a given site and time. The TQAP includes detailed plans for commissioning the BWMS, the experimental plan, decommissioning, and reporting the results. The TQAP identifies all organizations involved in the test and includes the BWMS manufacturer's documentation and performance claims. The TQAP also identifies the data to be recorded, operational and challenge parameters that define a valid test cycle, data analyses to be presented in the verification report and a schedule for testing. Appropriate statistical distributions shall be considered and used to analyse data.

2.4 The test facility performing the BWMS tests shall be independent. It shall not be owned by or affiliated with the manufacturer or vendor of any BWMS, or by the manufacturer or supplier of the major components of that equipment.

## **Avoiding sampling bias**

2.5 The sampling protocol must ensure organism mortality is minimized, e.g. by using appropriate valves and flow rates for flow control in the sampling facility, submerging nets during sampling collection, using appropriate sampling duration and handling times, and appropriate concentrating methodology. All methods to avoid sampling bias shall be validated to the satisfaction of the Administration.

## **Shipboard tests**

2.6 A shipboard test cycle includes:

- .1 the uptake of ballast water of the ship;
- .2 treatment of the ballast water in accordance with paragraph 2.8.4 of this annex by the BWMS;
- .3 the storage of ballast water on the ship during a voyage; and
- .4 the discharge of ballast water from the ship.

2.7 Shipboard testing of BWMS shall be conducted by the test facility, independent of the BWMS manufacturer, with the system being operated and maintained by the ships' crew as per the operation, maintenance and safety manual.

## ***Success criteria for shipboard testing***

2.8 In evaluating the performance of BWMS installation(s) on a ship or ships, the following information and results shall be supplied to the satisfaction of the Administration:

- .1 test plan to be provided prior to testing;
- .2 documentation that an in-line BWMS is of a capacity to reflect the flow rate of the ballast water pump for the TRC of the BWMS;
- .3 documentation that an in-tank BWMS is of a capacity to reflect the ballast water volume that it is intended to treat within a specified period of time;
- .4 the amount of ballast water tested in the test cycle on board shall be consistent with the normal ballast operations of the ship and the BWMS shall be operated at the TRC for which it is intended to be approved;
- .5 documentation showing that the discharge of each valid test cycle was in compliance with regulation D-2. For a test to be valid, the uptake water for the ballast water to be treated shall contain a density of viable organisms exceeding 10 times the maximum permitted values in regulation D-2.1;
- .6 sampling regime and volumes for analysis:
  - .1 for the enumeration of viable organisms greater than or equal to 50 µm or more in minimum dimension:
    - .1 influent water shall be collected over the duration of uptake as one time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of

- sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume shall be at least 1 m<sup>3</sup>. If a smaller volume is validated to ensure representative sampling of organisms, it may be used;
- .2 treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. The total sample volume shall be at least 3 m<sup>3</sup>;
  - .3 if samples are concentrated for enumeration, the organisms shall be concentrated using a mesh with holes no greater than 50 µm in the diagonal dimension. Only organisms greater than 50 µm in minimum dimension shall be enumerated; and
  - .4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;
- .2 for the enumeration of viable organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension:
- .1 influent water shall be collected over the duration of uptake as one, time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of three 1 mL subsamples shall be analysed in full to enumerate organisms;
  - .2 treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of six 1 mL subsamples shall be analysed in full to enumerate organisms;
  - .3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 µm and less than 50 µm in minimum dimension shall be enumerated; and

- .4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;
- .3 for the evaluation of bacteria:
  - .1 for the influent and discharge samples, the minimum 10 L sample referred to in paragraphs 2.8.6.2.1 and 2.8.6.2.2, or another sample at least 10 L in volume and collected in a similar manner should be used, a subsample of minimum 1 L may be transferred to a sterile container for analysis;
  - .2 a minimum of three subsamples of appropriate volume taken from the 1 L subsample described above shall be analysed for colony forming units of bacteria listed in regulation D-2; and
  - .3 the toxicogenic test requirements shall be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.
- .7 the test cycles including invalid test cycles shall span a period of not less than six months;
- .8 three consecutive test cycles in compliance with regulation D-2 are to be performed. Any invalid test cycle does not affect the consecutive sequence;
- .9 the six-month shipboard test period starts and ends with the completion of a successful test cycle or invalid test cycle that meets the D-2 standard. The three consecutive and valid test cycles that are required in paragraph 2.8.8 above must be suitably separated across the six-month period;
- .10 the source water for test cycles shall be characterized by measurement of salinity, temperature, particulate organic carbon, total suspended solids and dissolved organic carbon; and
- .11 for system operation throughout the test period, the following information shall also be provided:
  - .1 documentation of all ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;
  - .2 documentation that the BWMS was operated continuously throughout the test period for all ballasting and deballasting of the ship;
  - .3 documentation detailing water quality parameters identified by the test organization that should be provided as appropriate and practicable;

- .4 the possible reasons for an invalid test cycle, or a test cycle discharge failing the D-2 standard, which shall be investigated and reported to the Administration;
- .5 documentation of scheduled maintenance performed on the system during the test period;
- .6 documentation of unscheduled maintenance and repair performed on the system during the test period;
- .7 documentation of engineering parameters, monitored as appropriate to the specific system; and
- .8 a report detailing the functioning of the control and monitoring equipment.

### Land-based testing

2.9 The land-based testing provides data to determine the biological efficacy and environmental acceptability of the BWMS under consideration for type approval. The approval testing aims to ensure replicability and comparability to other treatment equipment.

2.10 Any limitations imposed by the BWMS on the testing procedure described here shall be duly noted and evaluated by the Administration.

2.11 The test set-up including the BWMS shall operate as described in the provided operation, maintenance and safety manual during at least five consecutive successful test cycles in each salinity.

2.12 A land-based test cycle shall include the uptake of ballast water by pumping, the storage of ballast water, treatment of ballast water within the BWMS (except in control tanks), and the discharge of ballast water by pumping. The order will be dependent on the BWMS.

2.13 At least two test cycles in each salinity tested shall be conducted in order to evaluate compliance with the D-2 standard at the minimum holding time specified by the BWMS manufacturer.

2.14 Test facilities carrying out identification of Relevant Chemicals and toxicity testing of the treated ballast water from test cycles with a storage time which is shorter or longer than five days shall ensure that sufficient volumes of treated water are collected after five days or are reserved after the efficacy testing to permit the requirements of guidelines<sup>5</sup> developed by the Organization, for approval of BWMS making use of Active Substances, to be assessed for at least one test cycle per salinity.

2.15 Land-based testing of BWMS shall be independent of the system manufacturer.

2.16 Testing shall occur using different water conditions sequentially as provided for in paragraphs 2.29 and 2.31 of this annex.

2.17 The BWMS shall be tested at its TRC or as given in paragraphs 2.25 to 2.28 of this annex for each test cycle. The equipment shall function to specifications during this test.

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<sup>5</sup> Refer to the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

2.18 The analysis of treated water discharge from each test cycle shall determine if the treated discharge meets regulation D-2.

2.19 The analysis of treated water discharge from the relevant test cycle(s) shall also be used to evaluate the formation of Relevant Chemicals as well as the toxicity of the discharged water for BWMS that make use of Active Substances. The same evaluation shall be conducted for those BWMS that do not make use of Active Substances or Preparations but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge. Toxicity tests of the treated water discharge shall be conducted, taking into account guidelines developed by the Organization.<sup>6</sup>

### ***Land-based testing set-up***

2.20 The test set-up for approval tests shall be representative of the characteristics and arrangements of the types of ships in which the equipment is intended to be installed. The test set-up shall therefore include at least the following:

- .1 the complete BWMS to be tested;
- .2 piping and pumping arrangements; and
- .3 the storage tank that simulates a ballast tank, constructed such that the water in the tank shall be completely shielded from light.

2.21 The control and treated simulated ballast tanks shall each include:

- .1 a minimum capacity of 200 m<sup>3</sup>;
- .2 the use of standard industry practices for design and construction for ships; surface coatings shall be in accordance with the *Performance standard for protective coatings of dedicated seawater ballast tanks on all new ships and of double-sided skin spaces of bulk carriers (PSPC)* (resolution MSC.215(82)); and
- .3 the minimum modifications required for structural integrity on land.

2.22 The control and treated simulated ballast tanks should include normal internal structures, including lightening and drainage holes.

2.23 The test set-up shall be pressure-washed with tap water, dried and swept to remove loose debris, organisms and other matter before starting testing procedures, and between test cycles.

2.24 The test set-up shall include facilities to allow sampling as described in paragraphs 2.40 and 2.41 of this annex and provisions to supply influents to the system, as specified in paragraphs 2.29, 2.30, 2.33 and 2.34 of this annex. The installation arrangements shall conform in each case with those specified and approved under the procedure outlined in section 7 of this Code.

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<sup>6</sup> Refer to paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

### **Ballast water management system scaling**

2.25 Scaling of the BWMS should take into account guidance developed by the Organization.<sup>7</sup> The Administration shall verify that the scaling used is appropriate for the operational design of the BWMS.

2.26 BWMS with at least one model with a TRC equal to or smaller than 200 m<sup>3</sup>/h shall not be downscaled.

2.27 For BWMS with at least one model that has a TRC higher than 200 m<sup>3</sup>/h or 1000 m<sup>3</sup>/h the following must be observed for land-based testing. In-line treatment equipment may be downsized for land-based testing, but only when the following criteria are taken into account:

- .1 BWMS with at least one model with a TRC higher than 200 m<sup>3</sup>/h but lower than 1,000 m<sup>3</sup>/h may be downscaled to a maximum of 1:5 scale, but may not be lower than 200 m<sup>3</sup>/h; and
- .2 BWMS with at least one model with a TRC equal to, or higher than, 1,000 m<sup>3</sup>/h may be downscaled to a maximum of 1:100 scale, but may not be lower than 200 m<sup>3</sup>/h.

2.28 In-tank treatment equipment shall be tested on a scale that allows verification of full-scale effectiveness. The suitability of the test set-up shall be evaluated by the manufacturer and approved by the Administration.

### **Land-based test design – inlet and outlet criteria**

2.29 For any given set of test cycles (five are considered a set) a salinity range shall be chosen for each cycle. Given the salinity of the test set-up for a test cycle in fresh, brackish and marine water, each shall have dissolved and particulate content in one of the combinations set out in the table below. Deviations from the marine and brackish salinity ranges of the table shall be reported and justified and the resulting tests shall not be less challenging for the BWMS than would be the circumstance if the deviations had not occurred:

	Salinity		
	Marine 28 – 36 PSU	Brackish 10 – 20 PSU	Fresh < 1 PSU
Dissolved organic carbon (DOC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Particulate organic carbon (POC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Total suspended solids (TSS)	> 1 mg/L	> 50 mg/L	> 50 mg/L

2.30 The source of the test water shall be natural water. Any augmentation of test water with dissolved organic carbon (DOC), particulate organic carbon (POC) or total suspended solids (TSS) to achieve the minimum required content shall be validated and approved by the Administration. As natural DOC constituents are complex and primarily of aromatic character, the type of added DOC is particularly critical to the evaluation of BWMS performance. The validation shall ensure that relevant properties of the augmented water (such as the oxidant demand/TRO decay and UV absorption in the range of 200 to 280 nm, the production of disinfectant by-products and the particle size distribution of suspended solids) are

<sup>7</sup> Refer to the *Guidance on scaling of ballast water management systems* (BWM.2/Circ.33/Rev.1).



equivalent, on a mg/L basis, to that of natural water that would quantitatively meet the challenge conditions. In addition, the validation shall ensure that augmentation does not bias a test for or against any specific treatment process. The test report shall include the basis for the selection, use and validation of augmentation.

2.31 The BWMS must be tested in conditions for which it will be approved. For a BWMS to achieve an unlimited Type Approval Certificate with respect to salinity, one set of test cycles shall be conducted within each of the three salinity ranges with the associated dissolved and particulate content as prescribed in paragraph 2.29 above. Tests under adjacent salinity ranges in the above table shall be separated by at least 10 PSU.

2.32 Use of standard test organisms (STO):

- .1 the use of standard test organisms (STO) is permissible if the challenge levels in naturally occurring water at the test facility require supplementation. The use of STO shall not be considered standard practice and the Administration shall in every case review that the selection, number and use of supplementary STOs ensures that the challenge posed to the BWMS provides an adequately robust test. The use of STOs shall not bias a test for or against any specific treatment process. They shall be locally isolated to ensure that the risk to the local environment is minimized; non-indigenous organisms which have the potential to cause harm to the environment shall not be used;
- .2 procedures, processes and guidance for the use of STO shall be based on the most relevant and up-to-date available scientific data. Such procedures, processes and guidance shall form a part of the testing facilities quality assurance regimes; and
- .3 the use of STO, including concentrations and species, shall be recorded within the test report. The test report shall include information pertaining to the evaluation and justification for the use of STO, an assessment of the impact of their use on other test parameters and potential impacts on the test being undertaken. The information contained within the report shall reflect both the positive and negative impacts of the use of STO.

2.33 The influent water shall include:

- .1 test organisms of greater than or equal to 50  $\mu\text{m}$  or more in minimum dimension that shall be present in a total density of preferably  $10^6$  but not less than  $10^5$  individuals per cubic metre, and shall consist of at least five species from at least three different phyla/divisions;
- .2 test organisms greater than or equal to 10  $\mu\text{m}$  and less than 50  $\mu\text{m}$  in minimum dimension that shall be present in a total density of preferably  $10^4$  but not less than  $10^3$  individuals per mL, and shall consist of at least five species from at least three different phyla/divisions;
- .3 heterotrophic bacteria that shall be present in a density of at least  $10^4$  living bacteria per mL; and
- .4 a variety of organisms which shall be documented according to the size classes mentioned above regardless of whether natural organism assemblages or cultured organisms were used to meet the density and organism variety requirements.

2.34 The following bacteria do not need to be added to the influent water, but shall be measured at the influent and at the time of discharge:

- .1 coliform;
- .2 Enterococcus group;
- .3 *Vibrio cholerae*; and
- .4 heterotrophic bacteria.

2.35 If cultured test organisms are used, local applicable quarantine regulations shall be taken into account during culturing and discharge.

#### ***Land-based monitoring and sampling***

2.36 Change of numbers of test organisms by treatment and during storage in the simulated ballast tank shall be measured using methods described in Part 4 of this annex (paragraphs 4.5 to 4.7).

2.37 It shall be verified that the treatment equipment performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

2.38 The range of operational flow rates that a BWMS is expected to achieve in service, at the maximum and minimum operational flow rates (where it is appropriate for that technology), shall be verified after the filter on the discharge side of the pump. The range of flow rate may be derived from empirical testing or from computational modelling. Where appropriate for the technology, demonstration of system efficacy at low flow rates shall reflect the need for flow reduction during the final stages of ballast operations.

2.39 Environmental parameters such as pH, temperature, salinity, dissolved oxygen, TSS, DOC, POC and turbidity (Nominal Turbidity Unit, NTU) shall be measured at the same time that the samples described are taken.

2.40 Samples during the test for the purposes of determining biological efficacy shall be taken at the following times and locations: immediately before the treatment equipment, immediately after the treatment equipment and upon discharge after the appropriate holding time.

2.41 The control and treatment cycles may be run simultaneously or sequentially. Control samples are to be taken in the same manner as the equipment test as prescribed in paragraph 2.40 above and upon influent and discharge.

2.42 Facilities or arrangements for sampling shall be provided to ensure representative samples of treated and control water can be taken that introduce as little adverse effects as possible on the organisms.

2.43 Samples described in paragraphs 2.40 and 2.41 above shall be collected with the following sampling regime and volumes for analysis:

- .1 for the enumeration of viable organisms greater than or equal to 50  $\mu\text{m}$  or more in minimum dimension:
  - .1 influent water shall be collected over the duration of uptake as one time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume shall be at least one cubic metre. If smaller volume is validated to ensure representative sampling of organisms, it may be used;
  - .2 control and treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. The total sample volume shall be at least 3  $\text{m}^3$ ;
  - .3 if samples are concentrated for enumeration, the organisms shall be concentrated using a mesh with holes no greater than 50  $\mu\text{m}$  in the diagonal dimension. Only organisms greater than 50  $\mu\text{m}$  in minimum dimension shall be enumerated; and
  - .4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;
- .2 for the enumeration of viable organisms greater than or equal to 10  $\mu\text{m}$  and less than 50  $\mu\text{m}$  in minimum dimension:
  - .1 influent water shall be collected over the duration of uptake as one, time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of three 1 mL subsamples shall be analysed in full to enumerate organisms;
  - .2 control and treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of six 1 mL subsamples shall be analysed in full to enumerate organisms;

- .3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 µm and less than 50 µm in minimum dimension shall be enumerated; and
  - .4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method; and
- .3 for the evaluation of bacteria:
- .1 for the influent and discharge samples, a minimum 10 L sample referred to in paragraphs 2.8.6.2.1 and 2.8.6.2.2 above, respectively, or another sample at least 10 L in volume and collected in a similar manner, should be used; a subsample of minimum 1 L may be transferred to a sterile container for analysis;
  - .2 a minimum of three subsamples of appropriate volume taken from the 1 L subsample described above shall be analysed for colony forming units of bacteria listed in regulation D-2; and
  - .3 the toxicogenic test requirements shall be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.

2.44 The samples shall be analysed as soon as possible after sampling, and analysed live within six hours or treated in such a way so as to ensure that proper analysis can be performed.

2.45 If in any test cycle the discharge results from the control water is of a concentration less than or equal to 10 times the values in regulation D-2.1, the test cycle is invalid.

### **Temperature**

2.46 The effective performance of BWMS through a ballast water temperature range of 0°C to 40°C (2°C to 40°C for fresh water) and a mid-range temperature of 10°C to 20°C shall be the subject of an assessment verified by the Administration.

2.47 This assessment may include:

- .1 testing during land-based, shipboard, laboratory or bench-scale testing; and/or
- .2 the use of existing data and/or models, provided that their source, suitability and reliability is reported.

2.48 The report submitted to the Administration shall contain all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the temperature assessment. The report shall include at least the information identified in paragraph 2.57 of this annex.

## **Evaluation of regrowth**

2.49 The evaluation of the regrowth of organisms shall be undertaken to the satisfaction of the Administration in land-based and/or shipboard testing in at least two test cycles in each salinity.

2.50 In the case of land-based testing being performed with a holding time of less than five days, a sufficient volume of treated uptake water shall be held under conditions similar to conditions in the relevant holding tank. In the case of shipboard testing, water shall be retained on board for the evaluation of regrowth during a shipboard test cycle. Additional bench-scale testing may be used to supplement the land-based and/or shipboard testing.

2.51 In the case of a BWMS that includes mechanical, physical, chemical and/or biological processes intended to kill, render harmless or remove organisms within ballast water at the time of discharge or continuously between the time of uptake and discharge, regrowth shall be assessed in accordance with sections "Shipboard tests" and "Land-based testing" of this annex with a holding time of at least five days.

2.52 Otherwise, the enumeration of organisms to assess regrowth shall be undertaken at least five days after the completion of all of the mechanical, physical, chemical and/or biological processes intended to kill, render harmless or remove organisms within ballast water.

2.53 Any neutralization of ballast water required by the BWMS shall occur at the end of the holding time and immediately before the enumeration of organisms.

2.54 The evaluation of regrowth is not intended to evaluate contamination in ballast tanks or piping, such as may arise from the presence of untreated water or residual sediments.

2.55 A report shall be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the evaluation of regrowth. The report shall include at least the information identified in paragraph 2.57 of this annex.

## **Reporting of test results**

2.56 After approval tests have been completed, a report shall be submitted to the Administration. This report shall include information regarding the test design, methods of analysis and the results of these analyses for each test cycle (including invalid test cycles), BWMS maintenance logs and any observed effects of the BWMS on the ballast system of the ship (e.g. pumps, pipes, tanks, valves). Shipboard test reports shall include information on the total and continuous operating time of the BWMS.

2.57 The reports submitted in accordance with paragraph 2.56 above shall contain at least the following information:

- .1 the name and address of the laboratory performing or supervising the inspections, tests or evaluations, and its national accreditation or quality management certification, if appropriate;
- .2 the name of the manufacturer;
- .3 the trade name, product designation (such as model numbers), and a detailed description of the equipment or material inspected, tested or evaluated;

- .4 the time, date, and place of each approval inspection, test or evaluation;
- .5 the name and title of each person performing, supervising, and witnessing the tests and evaluations;
- .6 executive summary;
- .7 introduction and background;
- .8 for each test cycle, inspection or evaluation conducted, summary descriptions of:
  - .1 experimental design;
  - .2 methods and procedures;
  - .3 results and discussion, including a description of any invalid test cycle (in the case of a report referred to in Part 2 of this annex) and a comparison to the expected performance; and
  - .4 in the case of land-based testing, test conditions including details on challenge water preparation in line with paragraph 2.30 of this annex;
- .9 a description or photographs of the procedures and apparatus used in the inspections, tests or evaluation, or a reference to another document that contains an appropriate description or photographs;
- .10 at least one photograph that shows an overall view of the equipment or material tested, inspected or evaluated and other photographs that show:
  - .1 design details; and
  - .2 each occurrence of damage or deformation to the equipment or material that occurred during the approval tests or evaluations;
- .11 the operational safety requirements of the BWMS and all safety-related findings that have been made during the inspections, tests or evaluations;
- .12 an attestation that the inspections, tests or evaluations were conducted as required and that the report contains no known errors, omissions or false statements. The attestation must be signed by the chief officer of the laboratory, or the chief officer's representative;
- .13 appendices, including:
  - .1 the complete test plan and the data generated during tests and evaluations reported under paragraph 2.57.8 above, including at least:
    - .1 for land-based tests, whether ambient, cultured or a mixture of test organisms have been used (including a species-level identification for cultured organisms, and an identification to the lowest possible taxonomic level for ambient organisms);

- .2 for shipboard tests, the operating parameters of the system during successful treatment operations (e.g. dosage rates, ultraviolet intensity and the energy consumption of the BWMS under normal or tested TRC, if available);
  - .3 for SDL, details of all procedures, methods, data, models, results, explanations and remarks, leading to validation; and
  - .4 invalid test information.
- .2 the QMP, the QAPP and quality assurance and quality control records;
  - .3 maintenance logs including a record of any consumable components that were replaced; and
  - .4 relevant records and test results maintained or created during testing.

2.58 The results of biological efficacy testing of the BWMS shall be accepted if during the land-based and shipboard testing conducted as specified in sections "Shipboard tests" and "Land-based testing" of this annex it is shown that the system has met the standard in regulation D-2 and that the uptake water quality requirements were met in all individual test cycles as provided in paragraph 4.7 below.

2.59 The test report shall include all test cycles during land-based and shipboard tests, including failed test cycles and invalid test cycles with the explanation required in paragraph 2.8.11.4 for both shipboard and land-based tests.

2.60 The Administration shall identify and redact commercially sensitive information (information that is proprietary and not related to the BWMS performance) and make all other information available to interested parties and the Organization. The information shall include all of the test reports, including failed tests from both land-based and shipboard testing.

### **PART 3 – SPECIFICATION FOR ENVIRONMENTAL TESTING FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS**

3.1 The electrical and electronic sections of the BWMS in the standard production configuration shall be subject to the relevant tests specified in paragraph 3.3 below at a laboratory approved for the purpose by the Administration or by the accreditation body of the laboratory, with relevant accreditation<sup>8</sup> covering the relevant test standards.

3.2 Evidence of successful compliance with the environmental tests below shall be submitted to the Administration by the manufacturer together with the application for type approval.

3.3 Equipment is to be tested taking into account international test specifications for type approval.<sup>9</sup>

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<sup>8</sup> Refer to *General requirements for the competence of testing and calibration laboratories* (ISO/IEC 17025:2017).

<sup>9</sup> Refer to IACS UR E10, Rev.6, October 2014 – *Test Specification for Type Approval*.

3.4 A report on environmental tests shall be submitted to the Administration and include at least the information identified in paragraph 2.57 of this Annex.

#### **PART 4 – SAMPLE ANALYSIS METHODS FOR THE DETERMINATION OF BIOLOGICAL CONSTITUENTS IN BALLAST WATER**

##### **Sample processing and analysis**

4.1 Samples taken during testing of BWMS are likely to contain a wide taxonomic diversity of organisms, varying greatly in size and susceptibilities to damage from sampling and analysis.

4.2 When available, widely accepted standard methods for the collection, handling (including concentration), storage, and analysis of samples should be used. These methods shall be clearly cited and described in test plans and reports. This includes methods for detecting, enumerating, and determining minimum dimension of and identifying organisms and for determining viability (as defined in this Code).

4.3 When standard methods are not available for particular organisms or taxonomic groups, methods that are developed for use shall be described in detail in test plans and reports. The descriptive documentation shall include any experiments needed to validate the use of the methods.

4.4 Given the complexity in samples of natural and treated water, the required rarity of organisms in treated samples under regulation D-2, and the expense and time requirements of current standard methods, it is likely that several new approaches will be developed for the analyses of the composition, concentration and viability of organisms in samples of ballast water. Administrations/Parties are encouraged to share information concerning methods for the analysis of ballast water samples, using existing scientific venues, and documents distributed through the Organization.

##### **Sample analysis for determining efficacy in meeting the discharge standard**

4.5 Sample analysis is meant to determine the species composition and the number of viable organisms in the sample. Different samples may be taken for determination of viability and for species composition.

4.6 The viability of organisms shall be determined taking into account guidance developed by the Organization<sup>10</sup> using methodologies appropriate to the ballast water treatment technology being tested. Such methodologies shall provide assurance that organisms not removed from ballast water have been killed or rendered harmless to the environment, human health, property and resources. Viability may be established by assessing the presence of one or more essential characteristics of life, such as structural integrity, metabolism, reproduction, motility or response to stimuli.

4.7 A treatment test cycle shall be deemed successful if:

- .1 it is valid in accordance with paragraph 2.8.5 (shipboard) or 2.29, 2.30, 2.33 and 2.47 (land-based testing) of this annex as appropriate;

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<sup>10</sup> Refer to the *Guidance on methodologies that may be used for enumerating viable organisms* (BWM.2/Circ.61).



- .2 the density of organisms greater than or equal to 50 µm in minimum diameter in the replicate samples is less than 10 viable organisms per cubic metre;
- .3 the density of organisms less than 50 µm and greater than or equal to 10 µm in minimum diameter in the replicate samples is less than 10 viable organisms per mL;
- .4 the density of *Vibrio cholerae* (serotypes O1 and O139) is less than 1 cfu per 100 ml, or less than 1 cfu per 1 g (wet weight) zooplankton samples;
- .5 the density of *E. coli* in the replicate samples is less than 250 cfu per 100 mL;
- .6 the density of Intestinal Enterococci in the replicate samples is less than 100 cfu per 100 mL; and
- .7 no averaging of test cycles, or the discounting of failed test cycles, has occurred.

4.8 It is recommended that a non-exhaustive list of standard methods and innovative research techniques be considered.<sup>11</sup>

#### **Sample analysis for determining eco-toxicological acceptability of discharge**

4.9 Toxicity tests of the treated water discharge shall be conducted taking into account guidelines developed by the Organization.<sup>12</sup>

### **PART 5 – SELF-MONITORING**

#### **Introduction**

5.1 BWMS shall monitor and store a minimum number of parameters for detailed evaluation. In addition, all system indications and alerts shall be stored and available for inspection. Data storage and retrieval shall follow common standards. This part gives an overview of the minimum required self-monitoring parameters.

#### **Monitoring of parameters**

5.2 The applicable self-monitoring parameters listed below shall be recorded for every BWMS.<sup>13</sup> Any additional parameters that are necessary to ascertain system performance and safety shall be determined by the Administration and stored in the system. If a parameter is not applicable due to the particulars of the system, the Administration may waive the requirement to record that parameter. Limiting operating conditions on the operation of the BWMS shall be determined by the manufacturer and approved by the Administration.

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<sup>11</sup> Suggested sources may include but are not limited to:

- .1 The Handbook of Standard Methods for the Analysis of Water and Waste Water
- .2 ISO standard methods
- .3 UNESCO standard methods
- .4 World Health Organization
- .5 American Society of Testing and Materials (ASTM) standard methods
- .6 United States EPA standard methods
- .7 Research papers published in peer-reviewed scientific journals
- .8 MEPC documents

<sup>12</sup> Refer to paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

<sup>13</sup> Associated guidance for a template on technical details of the monitoring parameters and record intervals to be developed by the Organization.

### **General information for all systems**

5.3 The information and applicable self-monitoring parameters to be recorded for all systems shall include, inter alia:

- .1 general information: ship name, IMO number, BWMS manufacturer and type designation, BWMS serial number, date of BWMS installation on ship, BWMS TRC and principle of treatment (in-line/in-tank);
- .2 operational parameters: all recorded parameters should be time tagged if applicable: BWMS operational modes and any transition modes, including bypass operations (e.g. uptake, discharge, warming-up, cleaning and start up), ballast water pump in operation (yes/no – if information is available from ship), flow-rate at system outlet, and indication of the ballast water tank that is involved in the ballast water operation when practicable;
- .3 it is recommended that positional information on ballast water operations and on the holding time should be recorded automatically. Otherwise it shall be entered manually in the ballast water record book as appropriate. Administrations are encouraged to apply automatic position information recording to ships which install BWMS during a ship's building to the greatest extent possible;
- .4 system alerts and indications: all systems shall have an alert regime. Every alert shall be logged and time stamped. To assist the inspections it would be helpful to record an alert summary after each ballast water operation automatically, if possible;
- .5 general alerts include: shutdown of system while in operation, when maintenance is required, BWMS bypass valve status and status of BWMS valves representing system operational mode as appropriate;
- .6 operational alerts: whenever a relevant parameter exceeds the acceptable range approved by the Administration, the system shall give an alert. In addition, an alert shall be logged and time stamped also when a combination of relevant parameters exceeds system specifications, even if each single parameter does not exceed its approved range. If a safety relevant parameter (safety for crew, cargo and/or the ship) related to the BWMS exceeds approved limits, an alert/alarm shall be mandatory (e.g. hydrogen level at appropriate measurement point(s));
- .7 the Administration may require additional alerts depending on the design of the system and for future developments; and
- .8 the SDL parameters and their corresponding data such as range, alarm limit, alert delay, etc., be password protected on a level above what is required for normal operation and maintenance, i.e. on a system administrator level. Change of any data or parameters which are password protected and interruption of the measurement (wire break, signal out of range) shall be automatically logged and retrievable on a maintenance access level.

## Data storage and retrieval

5.4 Storage of data shall follow the requirements in paragraphs 4.17 to 4.22 of this Code. The equipment shall be able to store a minimum number of self-monitoring parameters following common standards determined by the Organization.

5.5 The control and monitoring equipment shall automatically record the proper functioning or failure of a BWMS without user interaction and add a time stamp to every entry. Additionally, the system shall have a tool to produce summary text files for each ballast water operation on demand to support inspections work.

5.6 The system shall store the required data in an acceptable format to be able to display, print or export the data for official inspections. An acceptable format could be:

- .1 an internationally standardized readable format (e.g. text format, pdf, MS Excel); or
- .2 the extensible mark-up language (xml).

5.7 The equipment shall be so designed that, as far as is practical, it will not be possible to manipulate either the data being stored by the system or the data which has already been recorded. Any attempt to interfere with the integrity of the data shall be recorded.

5.8 Permanent deletion of recordings shall not be possible. The system shall be capable of storing recorded data for at least 24 months to facilitate compliance with regulation B-2 of the Convention. Where navigation equipment is connected to the monitoring system to provide data for recording, the interfaces shall be developed taking into account applicable parts of relevant international standards.<sup>14</sup>

## PART 6 – VALIDATION OF SYSTEM DESIGN LIMITATIONS

6.1 The objective of the SDL approach is twofold. Firstly, it ensures that the performance of the BWMS has been transparently assessed with respect to the known water quality and operational parameters that are important to its operation, including those that may not be specifically provided for in this Code. Secondly, it provides transparent oversight of BWMS performance claims by the manufacturer that may go beyond specific criteria in this Code. Although the validation of SDL yields information that is reported on the Type Approval Certificate, this information does not affect the eligibility of a BWMS to receive type approval.

6.2 The low and/or high parameter values for each SDL shall be validated to the satisfaction of the Administration as follows:

- .1 the validation shall be overseen by the Administration and shall consist of a rigorous evidence-based assessment of a specific claim by the BWMS manufacturer that the equipment will operate as intended between pre-stated parameter values;
- .2 tests to validate SDL shall be undertaken in accordance with paragraphs 2.2 to 2.4 of this annex. Such tests may be combined with land-based and/or shipboard testing if the QAPP establishes that the validation tests will not interfere with the specific procedures in Part 2 of this annex. Laboratory or bench-scale testing may also be used in the validation of SDL;

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<sup>14</sup> Refer to *Digital interfaces for navigational equipment within a ship* (IEC 61162).

- .3 methods other than testing, such as the use of existing data and/or models, may be used in the validation of SDL. The source, suitability and reliability of such methods shall be reported; and
- .4 validation is not intended as a stress-test of the BWMS or as a procedure for identifying equipment failure points. Validation shall be undertaken independently of the BWMS manufacturer and shall be separate from BWMS research and development activities. Data and models may be supplied by the manufacturer when appropriate but shall be independently assessed.

6.3 Claims of open-ended performance (expressed as the lack of either a low or a high parameter value for a System Design Limitation) shall also be validated.

6.4 BWMS manufacturers may include a margin of error in claiming SDL. For this reason, SDL should not necessarily be interpreted as the exact parameter values beyond which the BWMS is incapable of operation. The Administration shall take this into account in considering whether to include any additional restrictions on the Type Approval Certificate in connection with the validation of SDL.

6.5 SDL shall be established for all known parameters to which the design of the BWMS is sensitive that are important to the operation of the BWMS. In the case of SDL parameters that are also subject to specific criteria in Part 2 of this annex, the procedure set out in Part 2 shall be followed. For such parameters, the approach in paragraph 6.2 above may be used only to the extent that the performance claim goes beyond the specific criteria in Part 2.

6.6 A report shall be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the validation of SDL. The report shall include at least the information identified in paragraph 2.57 of this annex.

## **PART 7 – TYPE APPROVAL CERTIFICATE AND TYPE APPROVAL REPORT**

### **Type Approval Certificate**

7.1 The Type Approval Certificate of a BWMS shall:

- .1 identify the type and model of the BWMS to which it applies and identify equipment assembly drawings, duly dated;
- .2 identify pertinent drawings bearing model specification numbers or equivalent identification details;
- .3 include a reference to the full performance test protocol on which it is based;
- .4 identify if it was issued by an Administration based on a Type Approval Certificate previously issued by another Administration. Such a certificate shall identify the Administration that supervised conduction of the tests on the BWMS and a copy of the original test results shall be attached to the Type Approval Certificate of the BWMS;
- .5 identify all conditions and limitations for the installation of BWMS on board the ship;
- .6 include the SDL, which shall be listed under the heading "This equipment has been designed for operation in the following conditions";

- .7 include any restrictions imposed by the Administration due to the minimum holding time or in accordance with paragraph 6.4 of this annex; such restrictions shall include any applicable environmental conditions (e.g. UV transmittance, etc.) and/or system operational parameters (e.g. min/max pressure, pressure differentials, min/max Total Residual Oxidants (TRO) if applicable, etc.); and
- .8 include an appendix containing test results of each land-based and shipboard test cycle. Such test results shall include at least the numerical salinity, temperature, flow rates, and where appropriate UV transmittance. In addition, these test results shall include all other relevant variables. The Type Approval Certificate shall list any identified SDL parameters.

### **Type approval report**

7.2 The type approval report shall be submitted to the Organization and made available to the public and Member States by appropriate means. It shall contain at least:

- .1 information on the type approval of the BWMS, including:
  - .1 the approval date;
  - .2 the name of the Administration;
  - .3 the name of the manufacturer;
  - .4 the trade name and product designation (such as model numbers) of the BWMS; and
  - .5 a copy of the Type Approval Certificate including its appendices, annexes or other attachments;
- .2 an executive summary;
- .3 a description of the BWMS, including, in the case of BWMS using Active Substances, the following information:
  - .1 the name of the Active Substance(s) or Preparation(s) employed; and
  - .2 identification of the specific Marine Environment Protection Committee (MEPC) report and paragraph number granting Final Approval, taking into account guidelines developed by the Organization;<sup>15</sup>
- .4 an overview of the process undertaken by the Administration to evaluate the BWMS, including the name and role of each test facility, subcontractor and test organization involved in testing and approving the BWMS, the role of each report in the type approval decision, and a summary of the Administration's approach to overall quality assurance and quality control;
- .5 the executive summary of each test report prepared in accordance with paragraphs 2.48, 2.55 to 2.57, 3.4 and 6.6 of this Annex;

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<sup>15</sup> Refer to the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

- .6 the operational safety requirements of the BWMS and all safety-related findings that have been made during the type approval process;
- .7 a discussion section explaining the Administration's assessment that the BWMS:
  - .1 in every respect fulfilled the requirements of this Code, including demonstrating under the procedures and conditions specified for both land-based and shipboard testing that it met the ballast water performance standard described in regulation D-2;
  - .2 is designed and manufactured according to requirements and standards;
  - .3 is in compliance with all applicable requirements;
  - .4 has been approved taking into account the recommendations provided by the MEPC in the Final Approval of the BWMS, if any;
  - .5 operates within the SDL at the TRC, performance, and reliability as specified by the manufacturer;
  - .6 contains control and monitoring equipment that operates correctly;
  - .7 was installed in accordance with the technical installation specification of the manufacturer for all tests; and
  - .8 was used to treat volumes and flow rates of ballast water during the shipboard tests consistent with the normal ballast operations of the ship; and
- .8 the following annexes:
  - .1 appropriate information on quality control and assurance; and
  - .2 each complete test report prepared in accordance with paragraphs 2.48, 2.55 to 2.57, 3.4 and 6.6 of this annex.

7.3 The Administration may redact proprietary information of the manufacturer from the type approval report before submitting it to the Organization.

7.4 The Type Approval Certificate and the type approval report (including their entire contents and all annexes, appendices or other attachments) shall be accompanied by a translation into English, French or Spanish if not written in one of those languages.

7.5 Documents shall not be incorporated by reference into the Type Approval Certificate. The Administration may incorporate an annex by reference into the type approval report if the reference (e.g. internet URL) is expected to remain permanently valid. Upon any reference becoming invalid, the Administration shall promptly re-submit the type approval report to the Organization and include the referenced document or an updated reference to it; and the Organization shall promptly make the revised report available to the public and Member States through appropriate means.

**APPENDIX**

**BADGE OR CIPHER**

**(Limiting Operating Conditions apply)\***

*NAME OF ADMINISTRATION*

**TYPE APPROVAL CERTIFICATE OF BALLAST WATER MANAGEMENT SYSTEM**

This is to certify that the ballast water management system listed below has been examined and tested in accordance with the requirements of the specifications contained in the *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72)). This certificate is valid only for the ballast water management system referred to below.

Name of ballast water management system: .....

Ballast water management system manufactured by:.....

Under type and model designation(s) .....  
and incorporating:

To equipment/assembly drawing No.: ..... date: .....

Other equipment manufactured by: .....

To equipment/assembly drawing No.: ..... date: .....

Treatment Rated Capacity (m<sup>3</sup>/h): .....

A copy of this Type Approval Certificate shall be carried on board a ship fitted with this ballast water management system, for inspection on board the ship. If the Type Approval Certificate is issued based on approval by another Administration, reference to that Type Approval Certificate shall be made.

Limiting Operating Conditions imposed are described in this document.

(Temperature / Salinity)

Other restrictions imposed include the following: .....

This equipment has been designed for operation in the following conditions:\*\* .....

Official stamp

Signed .....

Administration of .....

Issued this ..... day of ..... 20 .....

Valid until this ..... day of .....20 .....

\*\*\*

\* Delete as appropriate.

\*\* Insert System Design Limitations.

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**ANNEX 6**

**RESOLUTION MEPC.301(72)  
(adopted on 13 April 2018)**

**AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE  
INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS,  
1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO**

**Amendments to MARPOL Annex VI**

**(ECAs and required EEDI for ro-ro cargo ships and ro-ro passenger ships)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-second session, proposed amendments to MARPOL Annex VI concerning ECAs and the required EEDI for ro-ro cargo ships and ro-ro passenger ships,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to MARPOL Annex VI, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 March 2019 unless prior to that date, not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 September 2019 upon their acceptance in accordance with paragraph 2 above;

4 INVITES FURTHER the Parties to consider the application of the aforesaid amendments to regulation 21 of Annex VI of MARPOL concerning new parameters for determination of reference values of the EEDI to ships entitled to fly their flag as soon as possible, prior to entry into force;

5 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

6 REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.



ANNEX

**AMENDMENTS TO MARPOL ANNEX VI**

**(ECAs and the required EEDI for ro-ro cargo ships and ro-ro passenger ships)**

**Regulation 13 – Nitrogen oxides (NO<sub>x</sub>)**

1 In paragraph 5.3, the words "an emission control area designated under paragraph 6 of this regulation" are replaced with the words "a NO<sub>x</sub> Tier III emission control area".

**Regulation 21 - Required EEDI**

2 In table 2 (Parameters for determination of reference values for the different ship types) of paragraph 3, rows 2.34 and 2.35 for ro-ro cargo ships and ro-ro passenger ships are replaced by the following:

2.34 Ro-ro cargo ship	1405.15	DWT of the ship	0.498
	1686.17*	DWT of the ship where DWT ≤ 17,000* 17,000 where DWT > 17,000*	
2.35 Ro-ro passenger ship	752.16	DWT of the ship	0.381
	902.59*	DWT of the ship where DWT ≤ 10,000* 10,000 where DWT > 10,000*	

\* to be used from phase 2 and thereafter.

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**ANNEX 11**

**RESOLUTION MEPC.304(72)  
(adopted on 13 April 2018)**

**INITIAL IMO STRATEGY ON REDUCTION OF GHG EMISSIONS FROM SHIPS**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(e) of the Convention on the International Maritime Organization (the Organization) concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution from ships,

ACKNOWLEDGING that work to address greenhouse gas (GHG) emissions from ships has been undertaken by the Organization continuously since 1997, in particular, through adopting global mandatory technical and operational energy efficiency measures for ships under MARPOL Annex VI,

ACKNOWLEDGING ALSO the decision of the thirtieth session of the Assembly in December 2017 that adopted for the Organization a strategic direction entitled "Respond to Climate Change",

RECALLING the United Nations 2030 Agenda for Sustainable Development,

- 1 ADOPTS the Initial IMO Strategy on Reduction of GHG Emissions from Ships (hereinafter the Initial Strategy) as set out in the annex to the present resolution;
- 2 INVITES the Secretary-General of the Organization to make adequate provisions in the Integrated Technical Cooperation Programme (ITCP) to support relevant follow-up actions of the Initial Strategy that may be further decided by the Committee and undertaken by developing countries, particularly least developed countries (LDCs) and small island developing States (SIDS);
- 3 AGREES to keep the Initial Strategy under review, with a view to adoption of a Revised IMO Strategy on reduction of GHG emissions from ships in 2023.

ANNEX

**INITIAL IMO STRATEGY ON REDUCTION OF GHG EMISSIONS FROM SHIPS**

**Contents**

- 1 INTRODUCTION
- 2 VISION
- 3 LEVELS OF AMBITION AND GUIDING PRINCIPLES
- 4 LIST OF CANDIDATE SHORT-, MID- AND LONG-TERM FURTHER MEASURES WITH POSSIBLE TIMELINES AND THEIR IMPACTS ON STATES
- 5 BARRIERS AND SUPPORTIVE MEASURES; CAPACITY BUILDING AND TECHNICAL COOPERATION; R&D
- 6 FOLLOW-UP ACTIONS TOWARDS THE DEVELOPMENT OF THE REVISED STRATEGY
- 7 PERIODIC REVIEW OF THE STRATEGY

## 1 INTRODUCTION

1.1 The International Maritime Organization (IMO) is the United Nations specialized agency responsible for safe, secure and efficient shipping and the prevention of pollution from ships.

1.2 The Strategy represents the continuation of work of IMO as the appropriate international body to address greenhouse gas (GHG) emissions from international shipping. This work includes Assembly resolution A.963(23) on *IMO policies and practices related to the reduction of greenhouse gas emissions from ships*, adopted on 5 December 2003, urging the Marine Environment Protection Committee (MEPC) to identify and develop the mechanisms needed to achieve the limitation or reduction of GHG emissions from international shipping.

1.3 In response to the Assembly's request, work to address GHG emissions from ships has been undertaken, including inter alia:

- .1 MEPC 62 (July 2011) adopted resolution MEPC.203(62) on *Inclusion of regulations on energy efficiency for ships in MARPOL Annex VI* introducing mandatory technical (EEDI) and operational (SEEMP) measures for the energy efficiency of ships. To date more than 2,700 new ships have been certified to the energy efficiency design requirement;
- .2 MEPC 65 (May 2013) adopted resolution MEPC.229(65) on *Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships*, which, among other things, requests IMO, through its various programmes (ITCP,<sup>1</sup> GloMEEP project,<sup>2</sup> MTCC network,<sup>3</sup> etc.), to provide technical assistance to Member States to enable cooperation in the transfer of energy efficient technologies, in particular to developing countries; and
- .3 MEPC 70 (October 2016) adopted, by resolution MEPC.278(70), amendments to MARPOL Annex VI to introduce the *data collection system for fuel oil consumption of ships*, containing mandatory requirements for ships to record and report their fuel oil consumption. Ships of 5,000 gross tonnage and above (representing approximately 85% of the total CO<sub>2</sub> emissions from international shipping) are required to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for "transport work".

1.4 This Initial Strategy is the first milestone set out in the *Roadmap for developing a comprehensive IMO Strategy on reduction of GHG emissions from ships* (the Roadmap) approved at MEPC 70. The Roadmap identifies that a revised Strategy is to be adopted in 2023.

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<sup>1</sup> Integrated Technical Cooperation Programme <http://www.imo.org>

<sup>2</sup> Global Maritime Energy Efficiency Partnerships <http://glomeep.imo.org>

<sup>3</sup> Global Maritime Technology Cooperation Centres Network <http://gmn.imo.org>

## Context

- 1.5 The Initial Strategy falls within a broader context including:
- .1 other existing instruments related to the law of the sea, including UNCLOS, and to climate change, including the UNFCCC and its related legal instruments, including the Paris Agreement;
  - .2 the leading role of the Organization for the development, adoption and assistance in implementation of environmental regulations applicable to international shipping;
  - .3 the decision of the thirtieth session of the Assembly in December 2017 that adopted for the Organization a Strategic Direction entitled "Respond to climate change"; and
  - .4 the United Nations 2030 Agenda for Sustainable Development.

## Emissions and emission scenarios

1.6 The *Third IMO GHG Study 2014* has estimated that GHG emissions from international shipping in 2012 accounted for some 2.2% of anthropogenic CO<sub>2</sub> emissions and that such emissions could grow by between 50% and 250% by 2050. Future IMO GHG studies would help reduce the uncertainties associated with these emission estimates and scenarios.

## Objectives of the Initial Strategy

- 1.7 The Initial Strategy is aimed at:
- .1 enhancing IMO's contribution to global efforts by addressing GHG emissions from international shipping. International efforts in addressing GHG emissions include the Paris Agreement and its goals and the United Nations 2030 Agenda for Sustainable Development and its SDG 13: "*Take urgent action to combat climate change and its impacts*";
  - .2 identifying actions to be implemented by the international shipping sector, as appropriate, while addressing impacts on States and recognizing the critical role of international shipping in supporting the continued development of global trade and maritime transport services; and
  - .3 identifying actions and measures, as appropriate, to help achieve the above objectives, including incentives for research and development and monitoring of GHG emissions from international shipping.

## 2 VISION

IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.

### 3 LEVELS OF AMBITION AND GUIDING PRINCIPLES

#### Levels of ambition

3.1 Subject to amendment depending on reviews to be conducted by the Organization, the Initial Strategy identifies levels of ambition for the international shipping sector noting that technological innovation and the global introduction of alternative fuels and/or energy sources for international shipping will be integral to achieve the overall ambition. The reviews should take into account updated emission estimates, emissions reduction options for international shipping, and the reports of the Intergovernmental Panel on Climate Change (IPCC), as relevant. Levels of ambition directing the Initial Strategy are as follows:

**.1 *carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships***

to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;

**.2 *carbon intensity of international shipping to decline***

to reduce CO<sub>2</sub> emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and

**.3 *GHG emissions from international shipping to peak and decline***

to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO<sub>2</sub> emissions reduction consistent with the Paris Agreement temperature goals.

#### Guiding principles

3.2 The principles guiding the Initial Strategy include:

**.1 the need to be cognizant of the principles enshrined in instruments already developed, such as:**

**.1 the principle of non-discrimination and the principle of no more favourable treatment, enshrined in MARPOL and other IMO conventions; and**

**.2 the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances, enshrined in UNFCCC, its Kyoto Protocol and the Paris Agreement;**

**.2 the requirement for all ships to give full and complete effect, regardless of flag, to implementing mandatory measures to ensure the effective implementation of this strategy;**

- .3 the need to consider the impacts of measures on States, including developing countries, in particular, on LDCs and SIDS as noted by MEPC 68 (MEPC 68/21, paragraphs 4.18 to 4.19) and their specific emerging needs, as recognized in the Organization's Strategic Plan (resolution A.1110(30)); and
- .4 the need for evidence-based decision-making balanced with the precautionary approach as set out in resolution MEPC.67(37).

#### **4 LIST OF CANDIDATE SHORT-, MID- AND LONG-TERM FURTHER MEASURES WITH POSSIBLE TIMELINES AND THEIR IMPACTS ON STATES**

##### **Timelines**

4.1 Candidate measures set out in this Initial Strategy should be consistent with the following timelines:

- .1 possible short-term measures could be measures finalized and agreed by the Committee between 2018 and 2023. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually;
- .2 possible mid-term measures could be measures finalized and agreed by the Committee between 2023 and 2030. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually; and
- .3 possible long-term measures could be measures finalized and agreed by the Committee beyond 2030. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually.

4.2 In aiming for early action, the timeline for short-term measures should prioritize potential early measures that the Organization could develop, while recognizing those already adopted, including MARPOL Annex VI requirements relevant for climate change, with a view to achieve further reduction of GHG emissions from international shipping before 2023.

4.3 Certain mid- and long-term measures will require work to commence prior to 2023.

4.4 These timelines should be revised as appropriate as additional information becomes available.

4.5 Short-, mid- and long-term further measures to be included in the Revised IMO GHG Strategy should be accompanied by implementation schedules.

4.6 The list of candidate measures is non-exhaustive and is without prejudice to measures the Organization may further consider and adopt.

## Candidate short-term measures

4.7 Measures can be categorized as those the effect of which is to directly reduce GHG emissions from ships and those which support action to reduce GHG emissions from ships. All the following candidate measures<sup>4</sup> represent possible short-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

- .1 further improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP, taking into account the outcome of the review of EEDI regulations;
- .2 develop technical and operational energy efficiency measures for both new and existing ships, including consideration of indicators in line with the three-step approach that can be utilized to indicate and enhance the energy efficiency performance of shipping, e.g. Annual Efficiency Ratio (AER), Energy Efficiency per Service Hour (EESH), Individual Ship Performance Indicator (ISPI) and Fuel Oil Reduction Strategy (FORS);
- .3 establishment of an Existing Fleet Improvement Programme;
- .4 consider and analyse the use of speed optimization and speed reduction as a measure, taking into account safety issues, distance travelled, distortion of the market or trade and that such measure does not impact on shipping's capability to serve remote geographic areas;
- .5 consider and analyse measures to address emissions of methane and further enhance measures to address emissions of Volatile Organic Compounds;
- .6 encourage the development and update of national action plans to develop policies and strategies to address GHG emissions from international shipping in accordance with guidelines to be developed by the Organization, taking into account the need to avoid regional or unilateral measures;
- .7 continue and enhance technical cooperation and capacity-building activities under the ITCP;
- .8 consider and analyse measures to encourage port developments and activities globally to facilitate reduction of GHG emissions from shipping, including provision of ship and shoreside/onshore power supply from renewable sources, infrastructure to support supply of alternative low-carbon and zero-carbon fuels, and to further optimize the logistic chain and its planning, including ports;
- .9 initiate research and development activities addressing marine propulsion, alternative low-carbon and zero-carbon fuels, and innovative technologies to further enhance the energy efficiency of ships and establish an International Maritime Research Board to coordinate and oversee these R&D efforts;
- .10 incentives for first movers to develop and take up new technologies;

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<sup>4</sup> The Initial Strategy is subject to revision based on fuel oil consumption data collected during 2019-2021 and does not prejudice any specific further measures that may be implemented in Phase 3 of the three-step approach.



- .11 develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels, in order to prepare for an implementation programme for effective uptake of alternative low-carbon and zero-carbon fuels;
- .12 actively promote the work of the Organization to the international community, in particular, to highlight that the Organization, since the 1990s, has developed and adopted technical and operational measures that have consistently provided a reduction of air emissions from ships, and that measures could support the Sustainable Development Goals, including SDG 13 on Climate Change; and
- .13 undertake additional GHG emission studies and consider other studies to inform policy decisions, including the updating of Marginal Abatement Cost Curves and alternative low-carbon and zero-carbon fuels.

### **Candidate mid-term measures**

4.8 Measures can be categorized as those the effect of which is to directly reduce GHG emissions from ships and those which support action to reduce GHG emissions from ships. All the following candidate measures represent possible mid-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

- .1 implementation programme for the effective uptake of alternative low-carbon and zero-carbon fuels, including update of national actions plans to specifically consider such fuels;
- .2 operational energy efficiency measures for both new and existing ships including indicators in line with three-step approach that can be utilized to indicate and enhance the energy efficiency performance of ships;
- .3 new/innovative emission reduction mechanism(s), possibly including Market-based Measures (MBMs), to incentivize GHG emission reduction;
- .4 further continue and enhance technical cooperation and capacity-building activities such as under the ITCP; and
- .5 development of a feedback mechanism to enable lessons learned on implementation of measures to be collated and shared through a possible information exchange on best practice.

### **Candidate long-term measures**

4.9 All the following candidate measures represent possible long-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

- .1 pursue the development and provision of zero-carbon or fossil-free fuels to enable the shipping sector to assess and consider decarbonization in the second half of the century; and
- .2 encourage and facilitate the general adoption of other possible new/innovative emission reduction mechanism(s).

## Impacts on States

4.10 The impacts on States of a measure should be assessed and taken into account as appropriate before adoption of the measure. Particular attention should be paid to the needs of developing countries, especially small island developing States (SIDS) and least developed countries (LDCs).

4.11 When assessing impacts on States the impact of a measure should be considered, as appropriate, inter alia, in the following terms:

- .1 geographic remoteness of and connectivity to main markets;
- .2 cargo value and type;
- .3 transport dependency;
- .4 transport costs;
- .5 food security;
- .6 disaster response;
- .7 cost-effectiveness; and
- .8 socio-economic progress and development.

4.12 The specification for and agreement on the procedure for assessing and taking into account the impacts of measures related to international shipping on States should be undertaken as a matter of urgency as part of the follow-up actions.

4.13 Disproportionately negative impacts should be assessed and addressed, as appropriate.

## **5 BARRIERS AND SUPPORTIVE MEASURES; CAPACITY-BUILDING AND TECHNICAL COOPERATION; R&D**

5.1 The Committee recognizes that developing countries, in particular LDCs and SIDS, have special needs with regard to capacity-building and technical cooperation.

5.2 The Committee acknowledges that development and making globally available new energy sources that are safe for ships could be a specific barrier to the implementation of possible measures.

5.3 The Committee could assist the efforts to promote low-carbon technologies by facilitating public-private partnerships and information exchange.

5.4 The Committee should continue to provide mechanisms for facilitating information sharing, technology transfer, capacity-building and technical cooperation, taking into account resolution MEPC.229(65) on *Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships*.

5.5 The Organization is requested to assess periodically the provision of financial and technological resources and capacity-building to implement the Strategy through the ITCP and other initiatives including the GloMEEP project and the MTCC network.

## **6 FOLLOW-UP ACTIONS TOWARDS THE DEVELOPMENT OF THE REVISED STRATEGY**

6.1 A programme of follow-up actions of the Initial Strategy should be developed.

6.2 The key stages for the adoption of a Revised IMO GHG Strategy in 2023 as set out in the Roadmap, are as follows:

Spring 2018 (MEPC 72)	Adoption of the Initial Strategy <sup>5</sup> including, inter alia, a list of candidate short-, mid- and long-term further measures with possible timelines, to be revised as appropriate as additional information becomes available
January 2019	Start of Phase 1: Data collection (Ships to collect data)
Spring 2019 (MEPC 74)	Initiation of Fourth IMO GHG Study using data from 2012-2018
Summer 2020	Data from 2019 to be reported to IMO
Autumn 2020 (MEPC 76)	Start of Phase 2: data analysis (no later than autumn 2020) Publication of Fourth IMO GHG Study for consideration by MEPC 76
Spring 2021 (MEPC 77)	Secretariat report summarizing the 2019 data pursuant to regulation 22A.10 Initiation of work on adjustments on Initial IMO Strategy, based on Data Collection System (DCS) data
Summer 2021	Data for 2020 to be reported to IMO
Spring 2022 (MEPC 78)	Phase 3: Decision step Secretariat report summarizing the 2020 data pursuant to regulation 22A.10
Summer 2022	Data for 2021 to be reported to IMO
Spring 2023 (MEPC 80)	Secretariat report summarizing the 2021 data pursuant to regulation 22A.10 Adoption of Revised IMO Strategy, including short-, mid- and long-term further measure(s), as required, with implementation schedules

6.3 The Marginal Abatement Cost Curve (MACC) for each measure, as appropriate, should be ascertained and updated, and then evaluated on a regular basis.

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<sup>5</sup> Initial IMO Strategy is subject to revision based on DCS data during 2019-2021 and does not prejudice any specific further measures that may be implemented in Phase 3 of the three-step approach.

## **7 PERIODIC REVIEW OF THE STRATEGY**

7.1 The Revised Strategy is to be adopted in spring 2023.

7.2 The Revised Strategy should be subject to a review five years after its final adoption.

7.3 The Committee should undertake the review including defining the scope of the review and its terms of reference.

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4 ALBERT EMBANKMENT  
LONDON SE1 7SR  
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MEPC.1/Circ.876  
16 April 2018

**SAMPLE FORMAT FOR THE CONFIRMATION OF COMPLIANCE, EARLY SUBMISSION  
OF THE SEEMP PART II ON THE SHIP FUEL OIL CONSUMPTION DATA COLLECTION  
PLAN AND ITS TIMELY VERIFICATION PURSUANT TO REGULATION 5.4.5 OF  
MARPOL ANNEX VI**

1 The Marine Environment Protection Committee, at its seventieth session, adopted resolution MEPC.278(70) on *Amendments to MARPOL Annex VI on Data collection system for fuel oil consumption of ships*, which entered into force on 1 March 2018.

2 In accordance with regulation 22.2 of MARPOL Annex VI, on or before 31 December 2018, in the case of a ship of 5,000 gross tonnage and above, the Ship Energy Efficiency Management Plan (SEEMP) shall include a description of the methodology that will be used to collect the data required by regulation 22A of MARPOL Annex VI and the process that will be used to report the data to the ship's Administration.

3 In addition, in accordance with regulation 5.4.5 of MARPOL Annex VI, the Administration shall ensure that for each ship to which regulation 22A applies, the SEEMP complies with regulation 22.2. This shall be done prior to collecting data under regulation 22A in order to ensure the methodology and process are in place prior to the beginning of the ship's first reporting period. Confirmation of compliance shall be provided to and retained on board the ship.

4 The Marine Environment Protection Committee, at its seventy-second session (9 to 13 April 2018), having recognized the need for smooth implementation and uniform application of the aforementioned amendments to MARPOL Annex VI, approved a sample format for the Confirmation of compliance pursuant to regulation 5.4.5 of MARPOL Annex VI, as set out in the annex, and agreed to encourage early submission of SEEMP part II from ships to the Administration or any organization duly authorized by it for its timely verification.

5 Member Governments are invited to:

- .1 encourage stakeholders concerned to submit SEEMP part II to the Administration or its recognized organization by 1 September 2018;
- .2 use the annexed sample format when applying regulation 5.4.5 of MARPOL Annex VI; and
- .3 bring the present circular to the attention of their Administration, industry, relevant shipping organizations, shipping companies and other stakeholders concerned, as appropriate.

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**ANNEX**

**SAMPLE FORMAT FOR CONFIRMATION OF COMPLIANCE**

**CONFIRMATION OF COMPLIANCE – SEEMP PART II**

Issued under the provisions of the Protocol of 1997, as amended, to amend the International Convention for the Prevention of Pollution by Ships, 1973, as modified by the Protocol of 1978 related thereto (hereinafter referred to as "the Convention") under the authority of the Government of:

.....  
(full designation of the Party)

by .....  
(full designation of the competent person or organization authorized under the provisions of the Convention)

Particulars of ship\*

Name of ship .....

Distinctive number or letters. ....

IMO Number<sup>†</sup> .....

Port of registry .....

Gross tonnage. ....

SEEMP part II date of revision, as applicable .....

THIS IS TO CONFIRM:

Taking into account the *2016 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP)* adopted by resolution MEPC.282(70), the ship's SEEMP has been developed and complies with regulation 22.2 of Annex VI of the Convention.

Issued at: .....  
(place of issue of Confirmation)

Date (dd/mm/yyyy) .....  
(date of issue) (signature of duly authorized official issuing the Confirmation)

(seal or stamp of the authority, as appropriate)

\* Alternatively, the particulars of the ship may be placed horizontally in boxes.

† In accordance with the *IMO Ship Identification Number Scheme*, adopted by the Organization by resolution A.1117(30).

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4 ALBERT EMBANKMENT  
LONDON SE1 7SR  
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

BWM.2/Circ.33/Rev.1  
10 May 2018

**INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT  
OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

**Guidance on scaling of ballast water management systems**

- 1 The Marine Environment Protection Committee (MEPC), at its sixty-second session (11 to 15 July 2011), approved the *Guidance on scaling of ballast water management systems* developed by the Sub-Committee on Bulk Liquids and Gases (BLG) at its fifteenth session (7 to 11 February 2011), disseminated as BWM.2/Circ.33.
- 2 MEPC 72 (9 to 13 April 2018) considered and approved a revision of the Guidance in order to reflect the requirements of the *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72)),<sup>1</sup> as set out in the annex.
- 3 Member Governments and international organizations are invited to bring the annexed Guidance to the attention of all parties concerned.
- 4 This circular supersedes BWM.2/Circ.33.<sup>1</sup>

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<sup>1</sup> As per paragraph 1.13 of the BWMS Code, the revised Guidance is also applicable to ballast water management systems approved taking into account the 2016 Guidelines (G8) (resolution MEPC.279(70)). Reference may be made to BWM.2/Circ.33 for ballast water management systems approved not later than 28 October 2018 under Guidelines (G8) (resolution MEPC.174(58)), taking into account the revised Guidance as appropriate.

## ANNEX

### GUIDANCE ON SCALING OF BALLAST WATER MANAGEMENT SYSTEMS

#### 1 REFERENCE IN THE CODE FOR APPROVAL OF BWMS

1.1 In addition to the definitions given in the BWMS Code, the following terms are defined:

- .1 *Base model* is a model of a ballast water management system that has successfully completed land-based testing as defined in the BWMS Code.
- .2 *Scaled model* is the ballast water management system model that is based on the base model but has been modified to accommodate a higher or lower capacity.
- .3 *Most vulnerable model* is the model of a series (i.e. the models to which the type approval certificate referenced in section 7 will apply) that is most prone to fail the requirements of the BWMS Code (safe, environmentally acceptable, practicable and biologically effective) within its series. This may be the case due to its specifications in comparison with other models of the series, e.g. because it provides the lowest tolerance regarding deviations of internal and/or external parameters. When identifying the least robust model of the series technical/operational parameters as well as environmental/water quality parameters and possible deviations should be taken into consideration.
- .4 *Mathematical modelling and/or calculations* may include computational fluid dynamics.

#### 2 DOCUMENTS TO BE SUBMITTED

2.1 The following documents should be submitted to the Administration, prior to performance of testing that may be required as part of the verification of scaled models:

- .1 test plan for verification of the scaling proposed;
- .2 mathematical modelling and/or calculations demonstrating that any parameters of the scaled models that would affect system performance are equivalent to those of the base model;
- .3 validation plan for mathematical modelling and/or calculations;
- .4 identification of operating limitations or System Design Limitations (SDL) for each scaled model;
- .5 the documentation should identify the key internal and external performance parameters (e.g. dosage concentration, UV dose, filter flux density, etc.) required to achieve the system's efficacy, and also specify the physical/environmental conditions and design parameters that affect these; and
- .6 documentation and drawings of base and scaled models.



### **3 REFERENCE IN THE PROCEDURE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS THAT MAKE USE OF ACTIVE SUBSTANCES (G9)**

When scaling from systems that have received Basic and Final Approval from the Committee according to the Procedure (G9), the manufacturer and the Administration should ensure that any conditions on Final Approval of the base unit are still met for the scaled system or systems.

## **4 TESTING REQUIREMENTS**

### **4.1 Experimental validation**

4.1.1 The mathematical modelling and/or calculations should be experimentally validated to the satisfaction of the Administration:

- .1 Experimental validation should be suitable for the technology.
- .2 Experimental validation should demonstrate the accuracy of the mathematical model and/or calculation relative to those parameters that impact the performance of the technology (see paragraph 2.1.5).
- .3 Experimental validation of the mathematical model and/or calculations may be undertaken in conjunction with land-based, shipboard or laboratory testing, as appropriate.

4.1.2 The validation should establish that the mathematical modelling and/or calculations accurately describes the parameters of all scaled models, including the largest and smallest models.

### **4.2 Land-based testing for purposes of scaling**

Land-based testing for purposes of scaling may be used, e.g. to validate claims for the scaled models beyond the tested limitations of the base model.

### **4.3 Shipboard testing for purposes of scaling**

- .1 Shipboard testing for purposes of scaling is intended to demonstrate the long-term operational robustness, safety and practicability of the models during normal ship operations.
- .2 The most vulnerable model of a series should be tested according to the requirements for shipboard tests required by the BWMS Code. This would then allow for verification testing of the scaling models, as necessary and appropriate, on the same ship.

3 The model required to be tested under paragraph 4.16 of the BWMS Code may not necessarily be the most vulnerable model.

### **4.4 Environmental tests**

The results of the environmental tests specified in part 3 of the annex to the BWMS Code, for each configuration of scaled models, should be provided if required by the Administration.

#### **4.5 Other tests**

Test results from additional laboratory testing or operational tests on-shore or onboard may be used to demonstrate relevant parameters of scaled models.

#### **5 REFERENCE TO BWM.2/CIRC.8**

Multiple models (referred to as units in BWM.2/Circ.8) of an approved BWMS installed in parallel fall within the scope of BWM.2/Circ.8.

#### **6 REPORTING**

A report on the validation of the mathematical modelling and/or calculations, as well as any other testing conducted in accordance with scaling, should be submitted to the Administration. The report should include at least the information identified in paragraph 2.57 of the annex to the BWMS Code. The Administration should annex this report to the type approval report submitted to the Organization in accordance with paragraph 6.10 of the BWMS Code.

#### **7 ISSUING OF TYPE APPROVAL CERTIFICATE FOR SYSTEMS USING SCALED MODELS**

The Type Approval Certificate issued by the Administration should include configurations of each and every scaled model if the scaling is done according to these procedures.

#### **8 APPLICATION TO EXISTING TYPE APPROVALS INVOLVING SCALED MODELS**

Administrations are encouraged to apply this Guidance to systems having received type approval involving scaled models prior to the adoption of this Guidance to the greatest extent possible.

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4 ALBERT EMBANKMENT  
LONDON SE1 7SR  
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

BWM.2/Circ.43/Rev.1  
10 May 2018

**INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT  
OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

**Guidance for Administrations on the type approval process  
for ballast water management systems**

1 The Marine Environment Protection Committee (MEPC), at its sixty-first session (27 September to 1 October 2010), approved the *Guidance for Administrations on the type approval process for ballast water management systems in accordance with Guidelines (G8)*, developed by the Sub-Committee on Bulk Liquids and Gases (BLG) at its fourteenth session (8 to 12 February 2010), disseminated as BWM.2/Circ.28.

2 MEPC 65 (13 to 17 May 2013) approved amendments to the Guidance, developed by BLG 17 (4 to 8 February 2013), disseminated as BWM.2/Circ.43, superseding BWM.2/Circ.28.

3 MEPC 72 (9 to 13 April 2018) considered and approved a revision of the Guidance in order to reflect the requirements of the *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72)),<sup>1</sup> as set out in the annex.

4 Member Governments and international organizations are invited to bring the annexed Guidance to the attention of all parties concerned.

5 This circular supersedes BWM.2/Circ.43.<sup>1</sup>

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<sup>1</sup> As per paragraph 1.13 of the BWMS Code, the revised Guidance is also applicable to ballast water management systems approved taking into account the 2016 Guidelines (G8) (resolution MEPC.279(70)). Reference may be made to BWM.2/Circ.43 for ballast water management systems approved not later than 28 October 2018 under Guidelines (G8) (resolution MEPC.174(58)), taking into account the revised Guidance as appropriate.

## ANNEX

### GUIDANCE FOR ADMINISTRATIONS ON THE TYPE APPROVAL PROCESS FOR BALLAST WATER MANAGEMENT SYSTEMS

#### 1 PURPOSE

1.1 This document provides guidance for Administrations on the procedure for evaluating an application for type approval of a ballast water management system (BWMS), in accordance with the Code for Approval of Ballast Water Management Systems (BWMS Code). The Guidance can act as an aide-memoire for Administrations and is not intended, in any way, to interfere with the authority of an Administration.

1.2 This document provides guidance on interpretation of the BWMS Code and does not replace or supersede the requirements of the Code.

1.3 This document is intended to provide guidance to Administrations on the details of the type approval to be reported to the Committee.

#### 2 KEY INSTRUMENTS

In evaluating an application for type approval of a BWMS, the latest version of the following instruments should be consulted:

- .1 International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention);
- .2 *Guidelines for approval of ballast water management systems (G8)* (resolutions MEPC.125(53), MEPC.174(58) and MEPC.279(70));
- .3 *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57));
- .4 *Guidelines for ballast water sampling (G2)* (resolution (MEPC.173(58));
- .5 *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72));
- .6 *Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to the ship's crew resulting from the treatment process (BWM.2/Circ.20)*;
- .7 *Information reporting on type-approved ballast water management systems* (resolution MEPC.175(58));
- .8 *Methodology for information gathering and conduct of work of the GESAMP-BWWG (BWM.2/Circ.13, as revised)*; and
- .9 other pertinent ballast water management related resolutions, guidance and circulars.

### **3 RECOMMENDATIONS FOR REQUIREMENTS OF MANUFACTURERS OR THEIR AGENTS**

3.1 To facilitate the type approval of a BWMS, the Administration should ensure that the manufacturers, or their agents have, at a minimum:

- .1 been informed if the Administration delegates to or utilizes the services of a third party quality assurance organization (e.g. recognized organization, nominated body, classification society, surveyors, etc.) in some, or all of the type approval processes;
- .2 understood the steps and requirements of the processes outlined in the instruments listed in section 2 of this Guidance;
- .3 a fully working system built that can be used in the type approval process. It should be noted that the construction procedures and materials for the unit tested need to be the same as for the follow-on production units;
- .4 undertaken preliminary testing to ensure that their BWMS is viable, will meet the D-2 standard of the BWM Convention, will work on board a ship and has been determined not to pose any unacceptable risk to the environment;
- .5 understood the extent of testing that needs to be completed by a recognized testing facility, including toxicity analysis;
- .6 provided a description of the preliminary test to the Administration that should at least include the following:
  - .1 the test set-up, including sampling points;
  - .2 responsible persons/organizations for all or portions of the preliminary testing;
  - .3 possible Quality Management Plan (QMP) of the testing facility;
  - .4 testing laboratories that will be used;
  - .5 Quality Assurance Project Plan (QAPP) for the preliminary test; and
  - .6 provision for survey of the test facility, if required;
- .7 provided a detailed report of the preliminary test results including, at least:
  - .1 toxicity data;
  - .2 Active Substances if relevant; and
  - .3 any Other Chemicals generated during the process;
- .8 an understanding of whether the system under consideration uses an Active Substance as defined in the BWM Convention. If it utilizes an Active Substance, the system will require additional approval under Procedure (G9), whilst the systems not using an Active Substance only need approval under the BWMS Code;

- .9 a contractual agreement to undertake the shipboard testing needed under the BWMS Code with the owner of a suitable ship;
- .10 arranged for a trained person from the land-based testing facility to operate the equipment being type-approved and ensure that for the shipboard test the ship's crew is familiar with the equipment and sufficiently trained to operate the equipment;
- .11 consulted with the classification society that the ship undertaking the shipboard testing is being registered, where necessary, and obtained approval for installation of the BWMS;
- .12 demonstrated by using mathematical modelling and/or calculations or by full-scale shipboard testing, that any up or down scaling will not affect the ultimate functioning and effectiveness on board a ship of the type and size for which the equipment will be certified. In doing so, the manufacturers should take into account all relevant guidance developed by the Organization;
- .13 prepared a type approval application in compliance with the BWMS Code, annex, part 1, which includes at least the following:
  - .1 detailed description of the design, construction, operation and functioning of the BWMS;
  - .2 preliminary assessment of the corrosion effects of the system proposed, if applicable;
  - .3 preliminary test results;
  - .4 technical manual;
  - .5 BWMS piping and instrumentation diagram (P&ID);
  - .6 link to the provisions required in a ballast water management plan;
  - .7 environmental and public health effects; and
  - .8 specific salinities to be tested;
- .14 provided the following, when submitting the type approval application:
  - .1 sufficient information to verify operation in different salinity ranges (fresh, brackish and marine water) in which the BWMS will operate;
  - .2 sufficient information to verify operation in the different temperature ranges (cold, temperate and tropical) in which the BWMS will operate;
  - .3 sufficient information to verify operation with the different sediment loads under which the BWMS will operate;

- .4 sufficient information to verify operation of the minimum effective treatment flow rate as well as the maximum Treatment Rated Capacity (TRC) including the duration of these tests; and
- .5 suggestions for improvements of the installation related to safety or additional testing R&D;
- .15 made all laboratory-scale and, if appropriate, full-scale land-based test results and documentation, including all unsuccessful, failed and invalid tests, available to the Administration; and
- .16 made all shipboard test results and documents, including all unsuccessful, failed and invalid tests, as well as detailed information of the test set up and flow rate at each test cycle, available to the Administration.

3.2 In accordance with paragraphs 4.17 to 4.22 of the Code for Approval of Ballast Water Management Systems (BWMS Code), Administrations should ensure that type-approved BWMS have a suitable self-monitoring system that will monitor and record sufficient data to verify correct operation of the system. Administrations should make every effort to ensure that newly installed BWMS that have already been granted type approval meet this recommendation within one year following approval of this Guidance. Administrations should issue treatment system particulars, including details of the self-monitoring system (as described in document MEPC 61/INF.19), for all type-approved systems.

#### **4 RECOMMENDATIONS FOR FACILITATING A TYPE APPROVAL EVALUATION**

4.1 For those Administrations using third party quality assurance organizations, due care should be taken to ensure all such arrangements are in place prior to initiating the type approval programme.

4.2 The Administration should provide the applicant with a document outlining contact details, the expected amount of time between submission and decision and any other requirements separate from the procedures and requirements outlined in the instruments listed in section 2 of this Guidance.

4.3 The Administration should verify that any recommendations made by MEPC during Basic and Final Approval have been addressed prior to issuing the Type Approval Certificate. In accordance with *Information reporting on type-approved ballast water management systems* (resolution MEPC.175(58)), the Administration should submit the final report of land-based and shipboard tests with the notification of type approval to the Organization. The reports should be available to Member States.

4.4 The Administration may certify a range of the BWMS capacities employing the same principles and technology, but due consideration should be given to limitations on performance which might arise from scaling up or scaling down.

4.5 The Administration should, in particular, review Standard Operating Procedures (SOP) for which an international standard has yet not been established.

#### **5 APPROVAL PROCESS**

5.1 Under the provisions of the BWM Convention, a BWMS is to be approved in accordance with the BWMS Code and, where appropriate, Procedure (G9).

5.2 The Administration should verify that the following issues have been specifically addressed by the manufacturer and, if the evaluation of the system is carried out by a third party organization, these issues should be relayed to the Administration to enable a decision on:

- .1 a comprehensive explanation of the physical and/or biochemical treatment processes used by the BWMS to meet the D-2 Standard in the BWM Convention. This should be undertaken by the manufacturer and any supporting data should be submitted in writing. Any system which makes use of, or generates, Active Substances, Relevant Chemicals, or free radicals during the treatment process to eliminate organisms in order to comply with the Convention should be submitted to the Organization for review under Procedure (G9), (Procedure (G9), paragraph 3.3);
- .2 whether a BWMS makes use of an Active Substance or not remains the prerogative of the responsible Administration. In making that determination, Administrations should take into account relevant GESAMP-BWWG recommendations and MEPC decisions as to whether a system should be subject to approval under Procedure (G9). When an Administration is unsure of whether a BWMS is subject to Procedure (G9), it may choose to submit such system for review under that Procedure (MEPC 59/24, paragraph 2.16);
- .3 the BWMS that the Administration determines are not subject to Procedure (G9), as provided in paragraph 2.4.11 of the annex to the BWMS Code, the toxicity testing procedures in paragraphs 5.2.2 to 5.2.7 of Procedure (G9) should be used when the system could reasonably be expected to result in changes to the treated water such that adverse impacts to receiving waters might occur upon discharge;
- .4 the approval documents that should include a piping and instrumentation diagram (P&ID) with parts list and material specification. Furthermore, wiring diagrams, function description of the control and monitoring equipment and description of regulator circuit of the BWMS;
- .5 information on the preliminary testing (methodology, test water composition, salinities tested, sampling, analysis laboratories, etc.);
- .6 accreditation of the BWMS Code land-based testing facility or body including their quality management plan (QMP) and quality assurance project plan (QAPP) to be used by the manufacturer for land-based testing;
- .7 approval and subsequent verification of the design, construction, operation and functioning of the equipment used for land-based and shipboard testing;
- .8 approval and subsequent verification of the land-based and shipboard test methodology, including the composition of the test water, and specific salinities to be tested which should be in line with the BWMS Code, Procedure (G9) and the Methodology for information gathering and conduct of work of the GESAMP-BWWG, as appropriate (waiver for multiple testing required);
- .9 approval and subsequent verification of the methodology used to take and store samples, the laboratory testing, the frequency of sampling and the analysis procedure for samples from land-based and shipboard testing;



- .10 approval and subsequent verification of the design, construction, operation and functioning of the equipment used for testing;
- .11 if the system is using an Active Substance, the applications for Final Approval will have to be checked and approved by the Administration prior to making a proposal for approval to the Organization. In addition, the cost-recovery fee for the scientific services provided by the GESAMP-BWWG will have to be submitted;
- .12 a safety assessment of the storage and handling of any chemicals is undertaken and approved in line with the technical guidance developed by the Organization (BWM.2/Circ.20);
- .13 a safety and hazard assessment of the installation, operation and maintenance of the BWMS on the shipboard test is undertaken and approved in line with the technical guidance developed by the Organization (BWM.2/Circ.20), and includes as a minimum:
  - .1 any potential impact on the crew health and safety; and
  - .2 references to the classification society safety and hazard rules and recommendations;
- .14 all electrical equipment used to operate the BWMS should be of a certified safety type required by the applicable national or international standard in respect of the hazardous areas where it is located; and
- .15 results of environmental testing as specified in part 3 of the annex to the BWMS Code.

5.3 For issuance of the Type Approval Certificate, the Administration should set the following requirements and provisions:

- .1 the validity of the approval should be revisited as appropriate;
- .2 in due time before the expiration of the approval, the manufacturer should prepare a report detailing the experiences with the system, including the results of any scientific research relevant to the system, as well as any results of port State controls, if available;
- .3 the occurrence of any unexpected harmful consequences of the operation of the BWMS should be reported by the manufacturer to the Administration immediately;
- .4 in accordance with the BWMS Code, the Type Approval Certificate should include details on all limiting operating conditions, restrictions and/or SDL determined by the Administration for the operation of the BWMS;
- .5 an annex to the Type Approval Certificate should contain the test results of each land-based and shipboard test run. Such test results should include at least the numerical salinity, temperature, flow rates, and where appropriate UV transmittance. In addition, these test results should include all other relevant variables;

- .6 the Type Approval Certificate should specify the components of the BWMS that are type-approved, including the manufacturer of each component; their operating ranges, including temperature, specific salinity and specify the possibility to use other similar components (e.g. filters) and the criteria for allowing such use;
- .7 a separate Type Approval Certificate should be provided for each type or model of the BWMS. However, if Administrations wish to do otherwise, it is recommended that the different types and models are clearly stated and the test each type and model has undergone clearly referred to with test results, operating ranges, salinity, TRC, etc.;
- .8 all accidents (e.g. accidental exposure, leakage) related to the BWMS should be reported;
- .9 any indications that the system is not performing to the standards set by the BWM Convention, the BWMS Code and/or any additional provisions set by the Administration should be reported by the manufacturer to the Administration immediately;
- .10 the Administration should have the opportunity to revoke the approval if these requirements are not met; and
- .11 MSC.1/Circ.1221 on *Validity of Type Approval Certification for marine products* should apply.

## **6 REPORTING OF THE TYPE APPROVAL**

6.1 The Administration should forward a report of the type approval process to the Organization, including the relevant documentation as specified in part 7 of the annex to the BWMS Code.

6.2 In particular, where under Procedure (G9) the Final Approval has been granted with recommendations by the GESAMP-BWWG, evidence that these recommendations have been satisfactorily addressed at type approval should be provided to the Organization. The report should specify the findings of the Administration together with any non-confidential information according to Procedure (G9).

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4 ALBERT EMBANKMENT  
LONDON SE1 7SR  
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

BWM.2/Circ.67  
20 April 2018

**INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT  
OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

**Data gathering and analysis plan for the experience-building phase  
associated with the BWM Convention**

1 The Marine Environment Protection Committee (MEPC), at its seventy-first session (3 to 7 July 2017), adopted resolution MEPC.290(71), establishing the experience-building phase associated with the BWM Convention, to allow the Marine Environment Protection Committee to monitor and improve the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004*.

2 MEPC 72 (9 to 13 April 2018) considered and approved the *Data gathering and analysis plan for the experience-building phase associated with the BWM Convention*, as set out in the annex.

3 Member Governments and international organizations are encouraged to use the annexed plan to gather, prepare and submit data to the experience-building phase (EBP).

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## ANNEX

### DATA GATHERING AND ANALYSIS PLAN FOR THE EXPERIENCE-BUILDING PHASE ASSOCIATED WITH THE BWM CONVENTION

#### 1 Overview of the experience-building phase

1.1 Resolution MEPC.290(71) established the experience-building phase associated with the BWM Convention (EBP). The annex to resolution MEPC.290(71) sets out the structure of the EBP, whose purpose is to allow the Marine Environment Protection Committee (the Committee) to monitor and improve the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004* (the Convention).

1.2 This data gathering and analysis plan for the experience-building phase associated with the BWM Convention (DGAP) supplements the annex to resolution MEPC.290(71) by setting out the specific arrangements for data gathering during the EBP, with regard to both the interfaces through which data may be submitted to the EBP and the specific data requirements for each interface. The DGAP also includes principles and organizational arrangements for analysing the data collected and sets out the timeline for the EBP. The DGAP is intended to be a living document, to be revised as needed by the Committee in light of developments and trends identified as the data gathering progresses.

1.3 The EBP consists of a data gathering stage, a data analysis stage and a Convention review stage. The EBP begins with the entry into force of the Convention and ends with the entry into force of a package of priority amendments. The priority amendments are those that implement improvements to the Convention needed before the end of non-penalization measures specific to the EBP that are set out in resolution MEPC.290(71). A timeline for the stages of the EBP is set out below in section 6.

1.4 Aside from the non-penalization set out in resolution MEPC.290(71), the EBP does not alter the basic roles, responsibilities, obligations and recommendations under the Convention, its guidelines and relevant guidance.

1.5 The EBP includes the more specific "trial period" associated with methods for sampling and analysing ballast water during port State control (PSC).<sup>1</sup> The arrangements for the trial period have been updated and incorporated within the EBP (see section 5 below), and data associated with the trial period will be gathered and analysed in parallel with data concerning other aspects of the Convention.

#### 2 Organizational arrangements

2.1 The EBP will be supported by the Secretariat, which will administer the data gathering and analysis stages on behalf of the Organization. Member States and other stakeholders are invited to make financial contributions in support of the Secretariat's work on data gathering and analysis. Consistent with the resources available, the Secretariat will undertake data handling and management, work with submitters to ensure the quality of data, make global data available to the Committee and its Ballast Water Review Group (BWRG) for consideration as appropriate, and manage the production of a data analysis report.

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<sup>1</sup> See document BLG 17/18, annex 6, *Recommendations related to the trial period for reviewing, improving and standardizing the Guidance for ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)*. These recommendations were agreed in principle at MEPC 65.

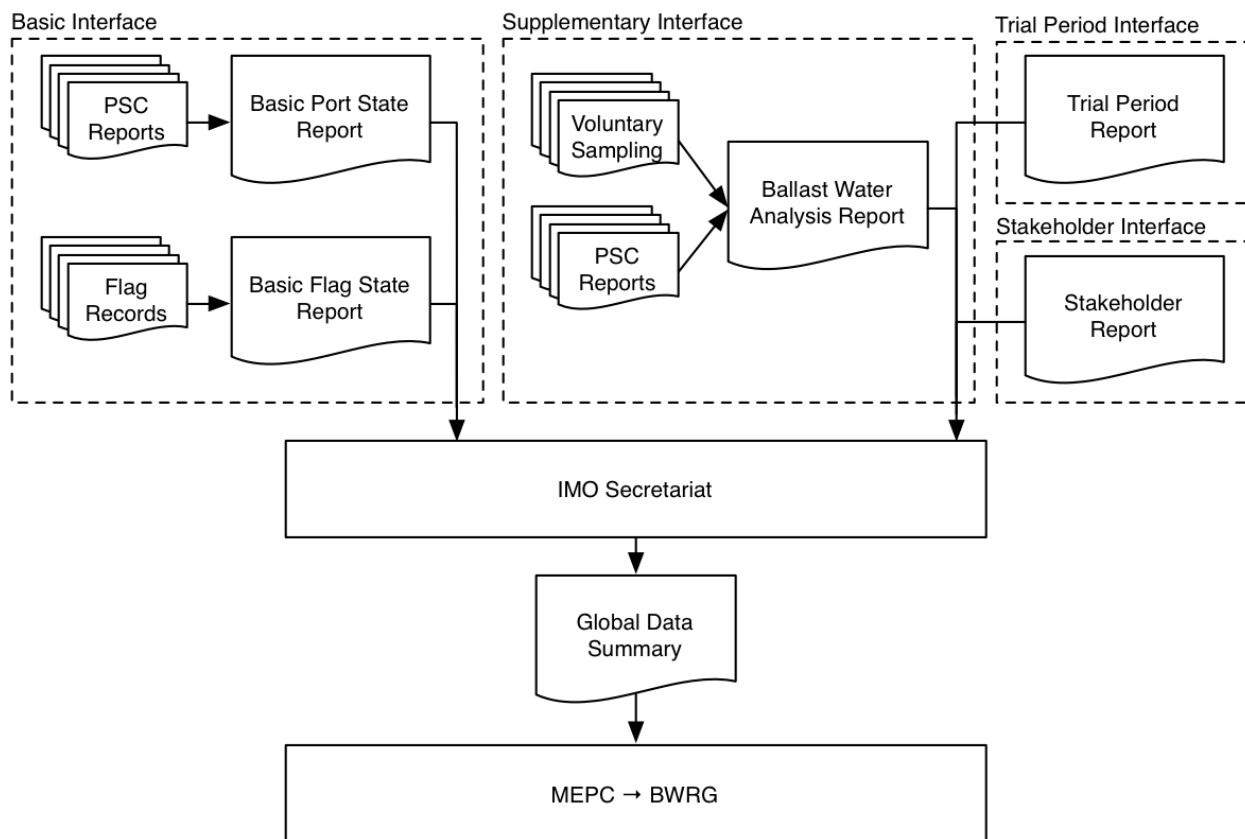
2.2 The BWRG should meet at each session of the Committee during the EBP. During the data gathering stage, the BWRG will consider the global data in order to register any arising issues with the Convention and propose early actions to the Committee if appropriate. The BWRG will also consider the analysis report and will be the primary forum for discussion during the Convention review stage, preparing the necessary materials and recommendations for the Committee's consideration. The BWRG should also continue to undertake reviews in accordance with regulation D-5 of the Convention during the EBP.

### 3 Data gathering and data quality

3.1 Member States are encouraged to participate fully in the EBP in order to maximize the information available to the Committee. However, participation is voluntary and Member States may determine the areas in which they wish to provide data. Four different interfaces are provided for submitting data:

- .1 **Basic interface** – straightforward reports from port and flag States that summarize basic data that would normally be collected by these States:
  - .1 basic flag State interface report (see appendix A); and
  - .2 basic port State interface report (see appendix B);
- .2 **Supplementary interface** – reports on specific topics from port States and flag States that would require greater analysis and/or additional research work:
  - .1 ballast water analysis interface report (see appendix C);
- .3 **Trial period interface** – reports from port States on methods for sampling and analysis during PSC (see appendix D); and
- .4 **Stakeholder interface** – reports from all stakeholders on their perspectives and experience (e.g. shipowners, BWMS manufacturers, recognized organizations) (see appendix E).

3.2 The process of data gathering is as follows. The State determines which of the interfaces it wishes to participate in. It assembles the appropriate data and completes the appropriate common data template appended to this document. The State submits the completed template as a report to the Secretariat. The Secretariat includes the data provided by the State in the EBP, making the information available to the Committee and ultimately to the BWRG (figure 1).



**Figure 1: Flowchart of data gathering**

3.3 States are particularly encouraged to submit basic reports, which impose the lowest administrative burden while contributing key information on the implementation of the Convention. It is understood that, in light of the additional effort involved, supplementary and trial period reports might be provided by a smaller number of States.

3.4 The EBP is intended to be inclusive and the stakeholder interface is provided to ensure that stakeholder perspectives are considered as the Convention is improved. For practical reasons, stakeholders are invited to provide their voluntary reports to a relevant Member State for aggregation and submission to this interface. In the case of shipowners, the relevant Member State is the flag State. States should ensure that any reports received are included in the EBP.

3.5 Commercial sensitivities will be protected through the use of aggregate reporting by port States and flag States. The EBP does not require ships or shipowners to be identified in data submissions.

3.6 Reports should be submitted in electronic format to the Secretariat, which will work with submitters to ensure that the data adheres to the DGAP, is in the correct format, and that the data quality of the EBP will be maintained when submissions are aggregated. The EBP will consider all data submitted by port States and flag States in accordance with the four interfaces and the report specifications set out in the appendices to this plan. States are requested to submit reports rather than raw data in order to manage the volume of information, and to ensure comparability between reports. Information submitted to the EBP will become part of the public domain.

3.7 The Secretariat, the Committee and the BWRG will maintain a consistent emphasis on data quality, recognizing that aggregating low-quality data with higher-quality data can diminish the usefulness of the product. This plan balances the need for high quality data with the need to achieve a straightforward process that maximizes participation in the EBP.

3.8 Member States are requested to pay particular attention to the accurate categorization of qualitative data, having regard to the report specifications. In the case of quantitative data, Member States are requested not to aggregate data gathered by multiple methods whose results are not comparable, and instead to submit multiple reports if necessary.

#### **4 Data analysis**

4.1 As opposed to the data gathering plan (which is highly structured so as to coordinate the input of many Member States), the plan for data analysis takes a more principles-based approach. This provides flexibility for relevant analysis and synthesis to be undertaken based on the data, taking into account emerging trends, and for conclusions to be conveyed in the most appropriate way to the Committee.

4.2 The analysis should shed light on specific provisions of the Convention and its guidelines, as well as on more general topics concerning the implementation itself, such as:

- .1 the progress of, and any challenges in, transitioning ships to the Convention;
- .2 the degree of compliance with regulations D-1 and D-2, and any systematic reasons for non-compliance;
- .3 whether compliance other than with regulations D-1 and D-2 is achievable or not;
- .4 any unforeseen operational, safety or environmental hazards associated with the methods used to comply with the Convention;
- .5 optional/additional actions taken by port States in implementing the Convention;
- .6 the outcome of the trial period on sampling and analysis; and
- .7 additional aspects of the Convention that require consideration during the analysis stage.

4.3 While the analysis will be based primarily on the data gathered through the EBP, it should also take into account any relevant information otherwise provided to the Organization pursuant to the Convention and its guidelines (e.g. notifications under regulation C-3 and BWMS type approval reports under Guidelines G8)).<sup>2</sup>

4.4 During the data analysis stage, the Secretariat will oversee the development of a final analysis report for the Committee and the BWRG. This report should convey the outcomes of data gathering, and provide deep insights into the Convention and any challenges associated with its implementation, such as those questions outlined above. The report should contain a separate chapter on the outcome of the trial period, including any recommendations for

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<sup>2</sup> In the context of this circular, the Guidelines (G8) refer to the guidelines adopted by resolution MEPC.174(58), the 2016 Guidelines (G8) adopted by resolution MEPC.279(70) and the *Code for approval of ballast water management systems* adopted by resolution MEPC.300(72), as may be appropriate.



sampling and analysis methods for PSC as appropriate. A draft of the final analysis report should be provided to the Committee by the Secretariat for consideration and comment by the BWRG prior to completion of the report. The specific terms of reference for this report should be approved by the Committee towards the end of the data gathering stage. The terms of reference may direct the analysis, inter alia, to also:

- .1 take into account additional information accepted by the Committee that has come to light other than through the EBP;
- .2 undertake additional transparent research to identify reasons for patterns emerging within the data that cannot be gleaned from the data itself; and/or
- .3 make recommendations on specific aspects of the Convention approach for consideration by the BWRG and the Committee during the Convention review stage.

## **5 Trial period and other sampling and analysis**

5.1 MEPC 65 approved the *Guidance on ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)* (BWM.2/Circ.42). This Guidance sets out recommended methodologies and approaches to sampling and analysis for testing compliance with the standards described in regulations D-1 and D-2 of the Convention. Member States and observers were encouraged to further develop sampling and analysis protocols towards later revisions of the Guidance. The Guidance was revised by MEPC 68 and subsequently disseminated as BWM.2/Circ.42/Rev.1.

5.2 Recognizing that many of the sampling and analysis methods in the Guidance had not been adequately validated, the methods in the Guidance were not fully integrated in the *Guidelines for port State control under the BWM Convention* (resolution MEPC.252(67)) (PSC Guidelines) and MEPC 65 agreed in principle with recommendations for a trial period for reviewing, improving and standardizing the Guidance (as set out in annex 6 to document BLG 17/18). These recommendations are being addressed through the present DGAP.

5.3 As an element of the EBP, the trial period is intended to gather and analyse data on the practical utility for PSC of the methodologies and approaches to sampling and analysis for compliance set out in BWM.2/Circ.42/Rev.1. Recognizing the non-mandatory nature of the Guidance and the Committee's encouragement that sampling and analysis protocols be further developed, the trial period is also intended to gather and analyse data on other sampling and analysis protocols in use by port States. It is to be noted that MEPC 64 agreed that sampling for PSC should be no more stringent than the sampling used for type approval of a BWMS.

5.4 Data relating to the trial period should be analysed with regard to validity, practicability (e.g. cost-effectiveness, timeliness and general applicability with regard to ship type and geographic region) and effectiveness in assessing compliance (e.g. consistency with type approval sampling procedures). The Committee may revise BWM.2/Circ.42/Rev.1 during the EBP as appropriate.

5.5 During the EBP, port States should share the results of the sampling and analysis process in accordance with chapter 3 of the PSC Guidelines, making clear the trial nature of the procedure.

5.6 The goal at the end of the EBP is to have a suite of accepted procedures that can be used for sampling and analysing ballast water in a globally consistent way. The finalization of this suite of accepted procedures should be done during the Convention review stage, on the basis of the data gathered and analysed in accordance with this DGAP. At least one standard precise protocol for indicative and detailed analysis of organisms at each size class is desired.

5.7 Ballast water sampling and analysis during the EBP may be undertaken:

- .1 on a mandatory basis, by or under the authority of a PSC officer pursuant to article 9 of the Convention (in which case the inspection should be in accordance with the PSC Guidelines); or
- .2 independently of a PSC inspection with the voluntary participation of the ship (in which case the sampling may be undertaken by appropriate personnel of the port State, the flag State or another entity).

5.8 The ship should be advised of the context of sampling and whether participation is voluntary or mandatory before a sample is taken. Before voluntary sampling begins, the ship should be advised of any consequences that could follow if the ballast water is found to be non-compliant with the standards in regulations D-1 or D-2 (as appropriate).

5.9 Data derived from both voluntary and PSC-related sampling and analysis will be equally informative to the Committee concerning the effectiveness of BWMS in reaching the standard described in regulation D-2. Therefore, reports on the results of both voluntary and PSC-related sampling and analysis should be reported together through the supplementary EBP interface. Regardless of the voluntary or mandatory nature of any sampling and analysis, quality assurance and quality control should be ensured.

5.10 Only sampling and analysis done in association with PSC inspections will be informative to the Committee concerning the practicability and utility of particular sampling and analysis methods for PSC purposes. Therefore, only data derived from PSC inspections should be reported through the trial period interface.

## **6 Timeline**

6.1 The timeline for the EBP should be short enough to ensure that the outcomes of the EBP are relevant to the Convention review stage, but long enough to generate a reasonable picture of the implementation of the Convention.

6.2 The EBP should unfold according to the following timeline:

- .1 a summary of any data received to date should be submitted by the Secretariat to MEPC 74;
- .2 an aggregate data report, reflecting submissions to the EBP through the second year of experience with the Convention, should be submitted by the Secretariat to MEPC 75, at which the Committee is also expected to take stock of this timeline;
- .3 the next aggregate data report, reflecting submissions to the EBP concerning the third year of experience with the Convention, should be submitted by the

- Secretariat to MEPC 76,<sup>3</sup> at which the Committee should also finalize the draft terms of reference for the data analysis report;
- .4 the draft data analysis report should be submitted to MEPC 77;
- .5 the final data analysis report should be submitted to MEPC 78, at which the Committee should also agree to the prioritized evidence-based list of issues with the Convention; and
- .6 the package of amendments to the Convention should be submitted to MEPC 79.

**Table 1: Summary of the EBP timeline**

<b>MEPC session</b>	<b>Timing</b>	<b>Milestone</b>	<b>EBP / MEPC action</b>
73	Autumn 2018	Convention has been in force one year	
74	Spring 2019		First year of data available.
75	Spring 2020	Convention has been in force two years	Second year of data available, stocktaking of EBP timeline.
76	Autumn 2020	Convention has been in force three years	Partial third year of data available, enough to agree to data analysis report terms of reference.
77	Spring 2021		Full third year of data available, Draft analysis report received.
78	Spring 2022	Convention has been in force four years	Final analysis report received. Convention issues agreed.
79	Autumn 2022	Convention has been in force five years	Package of amendments submitted to the Parties.

<sup>3</sup> This may reflect a partial year, recognizing that the deadline for document submission to the meeting would occur before the end of the third year that the Convention is in force. The complete data for the third year is expected to be available and taken into account during the preparation of the draft data analysis report.

**APPENDIX A: BASIC INTERFACE: BASIC FLAG STATE REPORT TEMPLATE**

Part 1: Fleet and its ballast water management plans			Response
Member State:			
Time period of report			
Date report prepared			
Ships to which Convention applies:	Total number of ships	Container ships	
		Bulk carriers	
		Tankers	
		Ferries	
		Cruise ships	
		Other (attach details)	
	Number currently subject to regulation D-2		
	Number fitted with BWMS	Electro-chlorination	
		Ozonation	
		Other chemical injection	
		Ultraviolet	
Other (attach details)			
Approved ballast water management plans	Total number of approved plans		
	Number of approved plans that include:	D-1 procedures	
		Contingency measures	
		Exemptions (regulation A-4)	
		Other methods (regulation B-3.7)	
		Use of reception facilities (regulation B-3.6)	
		Prototype BWMS (regulation D-4)	

Part 2: Outcome of ballast water surveys			Response
Number of surveys undertaken	Initial		
	Annual		
	Renewal		
	Intermediate		
Deficiencies noted during these surveys	Mechanical		
	Physical		
	Treatment process		
	Electrical		

Part 2: Outcome of ballast water surveys			Response
(even if later resolved)	Piping		
	Location		
	Maintenance and cleaning		
	Sampling facilities		
	Other (attach details)		

Part 3: Reported accidents and defects			Response
Number of reports of accidents to the ship and/or defects (regulation E-1.7)	Originating outside the ship's ballast water system		
	Originating in the ship's ballast water system	BWMS treatment equipment	
		BWMS control and monitoring equipment	
		Other aspect of the ballasting system (attach details)	
Number of other safety incidents reported to the flag State that relate to the Convention	Associated with the ship's ballast water system	BWMS treatment equipment	
		BWMS control and monitoring equipment	
		Other aspect of the ballasting system (attach details)	
	Associated with the storage or handling of Active Substances (including neutralizers)		
	Associated with the use of ballast water to control trim, list, draught, stability or stresses of the ship (attach details)		
	Other (attach details)		

**APPENDIX B: BASIC INTERFACE: BASIC PORT STATE REPORT TEMPLATE**

Part 1: PSC inspection outcomes			Response
Member State:			
Time period of report			
Date report prepared			
Total number of inspections undertaken	With no ballast water sample		
	With a ballast water sample <sup>4</sup>	Analysed with respect to regulation D-1	
		Analysed with respect to regulation D-2	
Number of PSC inspections by outcome	Satisfactory		
	Unsatisfactory	Valid certificate not on board	
		Approved ballast water management plan not on board	
		Deficiency in record book entries	
		Ship not in compliance with regulation D-1	
		Ship not in compliance with regulation D-2 (BWMS was installed, maintained and operated correctly)	
		Ship not in compliance with regulation D-2 (BWMS was not installed, maintained and operated correctly)	
		Maintenance issues	
		Crew not designated or unfamiliar with ballast water responsibilities	
		Unsanctioned changes to structure, equipment, fittings, arrangements or material	
		BWMS not used in accordance with operational instructions	
		BWMS and equipment not in good working order or treatment not fully operational	
		BWMS safety procedures not followed	
		BWMS has been bypassed	
Other (attach details)			

<sup>4</sup> Results of sampling/analysis should be reported through the Supplementary Interface (together with the results of non-PSC sampling/analysis).

<b>Part 2: Actions arising from unsatisfactory inspections (report number of actions)</b>			
<b>Action</b>	<b>Deficiency concerning regulation D-1</b>	<b>Deficiency concerning regulation D-2 or a BWMS</b>	<b>Deficiency concerning other aspect of the Convention</b>
No action taken			
Information/advice provided			
Warning			
Sanction			
Detention			
Exclusion			
Other			



<b>Part 3: Implications of unsatisfactory inspections for ballast water discharge (report number of discharges)</b>				
<b>Action</b>		<b>Deficiency concerning regulation D-1</b>	<b>Deficiency concerning regulation D-2 or a BWMS</b>	<b>Deficiency concerning other aspect of the Convention</b>
Discharge permitted without contingency measure				
Discharge permitted following contingency measure	Ballast water exchange			
	Emergency treatment			
	Discharge ashore			
	Other (attach details)			
Discharge not permitted				
Other				

**APPENDIX C: SUPPLEMENTARY INTERFACE: BALLAST WATER ANALYSIS REPORT TEMPLATE**

Both port and flag States are invited to submit this report if they have engaged in ballast water sampling and analysis.

**Report for submission**

Part 1: Identification			Response
Member State:			
Time period of report			
Date report prepared			

Part 2: Summary of ballast water sampling and biological analysis***									
Method		Sample group					Results for group		
Sampling method *	Analysis method *	Purpose (PSC or other) **	Ballast water salinity (F/B/S) **	Ship ballast water management method **	BWMS type (if any) **	BWMS/ship issues Yes/No **	# of ships sampled	# fails per size class	Degree of failures per size class (mean and standard deviation)

- \* These columns should reference attached details on sampling methods (including probe type and sampling device) and analysis methods (whether indicative or detailed).
- \*\* These columns should report standard categories.
- \*\*\* Information from samples should not be combined and reported on the same line unless the samples share all the same values for the blue columns.

Part 3: Summary of ballast water sampling and chemical analysis***								
Method		Sample group				Results for group		
Sampling method *	Analysis method *	Ballast water salinity (F/B/S) **	Ship ballast water management method **	BWMS type (if any) **	BWMS/ship issues Yes/No **	# of ships sampled	Residual TRO (mean and standard deviation)	Relevant Chemical concentrations (add columns for mean and standard deviation of each specific chemical considered)

\* These columns should reference attached details on sampling methods (including probe type and sampling device) and analysis methods (whether indicative or detailed).

\*\* These columns should report standard categories.

\*\*\* Information from samples should not be combined and reported on the same line unless the samples share all the same values for the blue columns.

Part 4: Information to be submitted concerning each ballast water sample analysed																									
Standard assessed (D1/D2)	Measurement type (e.g. ≥50 µm size class)	Measurement result (e.g. count/volume ± standard error)	Isokinetic sample collection (probe size, flow rates and location correct) (Y/N)	Total volume of water discharged from sampled tanks during sampling (m <sup>3</sup> )	Volume of sample(s) collected (indicate L or m <sup>3</sup> )	Was the sample(s) concentrated before analysis (Y/N)	Analysis method	Number of subsamples analysed	Analysis completed within standard holding time (Y/N)	Analysis completed by (affiliation)	Exchange conducted (Y/N)	BWMS utilized (Y/N)	BWMS manufacturer and model	Date BWMS installed	Duration BWMS in regular use (# treatment cycles)	Time since last calibration of BWMS sensor (months)	Ship reports difficulty with BWMS operation/maintenance in general (Y/N)	BWMS alarm occurred during sample treatment (Y/N)	BWMS maintenance up to date (Y/N)	Ballast water source location(s)	Age of ballast water (days)	Ballast water salinity at uptake/treatment (PSU)	Ballast water temperature at uptake/treatment (°C)	Maximum Allowable Discharge Concentration exceeded (Y/N)	Any other deficiencies during PSC inspection (Y/N)

**APPENDIX D: TRIAL PERIOD INTERFACE: TRIAL PERIOD REPORT TEMPLATE**

<b>Part 1: Identification</b>	<b>Response</b>
Member State:	
Time period of report	
Date report prepared	

<b>Part 2: Sampling (provide one copy per sampling method used and attach relevant documentation)</b>		<b>Response</b>
Sampling	Name of method/approach	
	Comments on validity	
	Comments on cost-effectiveness	
	Comments on timeliness	
	Comments on consistency with the type-approval sampling procedures in Guidelines (G8)*	

<b>Part 3: Analysis (provide one copy per analysis method used, and attach relevant documentation)</b>		<b>Response</b>
Analysis	Name of method/approach	
	Comments on validity	
	Comments on cost-effectiveness	
	Comments on timeliness	
	Comments on consistency with the type-approval sampling procedures in Guidelines (G8)*	

\* In the context of this circular, the Guidelines (G8) refer to the guidelines adopted by resolution MEPC.174(58), the 2016 Guidelines (G8) adopted by resolution MEPC.279(70) and the Code for approval of ballast water management systems adopted by resolution MEPC.300(72), as may be appropriate.

**APPENDIX E: STAKEHOLDER INTERFACE: STAKEHOLDER REPORT TEMPLATE**

*Instructions:*

- Please categorize the stakeholder reports by type according to the table below, and submit a separate template for each type of report.
- Attach the text of the stakeholder reports (or a summary of the reports).
- Reports should be appropriately redacted in accordance with paragraph 3.5 of the data gathering and analysis plan.
- Duplicate reports should not be submitted. Reports from ships should be forwarded through the flag State of the ship.
- The reports submitted should pertain to specific aspects of the Convention and its implementation. Administrations are requested to review the reports and submit only information that is pertinent to the EBP.

Part 1: Identification	Response
Member State:	
Time period of report	
Date report prepared	

Part 2: Category of attached reports <i>(Please select only one category per submitted stakeholder report template)</i>		Mark one category below
Shipowner	Obtaining, fitting, commissioning and surveying BWMS	
	Maintaining and operating a BWMS	
	Regarding other aspects of the Convention	
	Other	
Recognized organization		
BWMS manufacturer		
Other (please identify category)		